Santa Clara Valley Water District

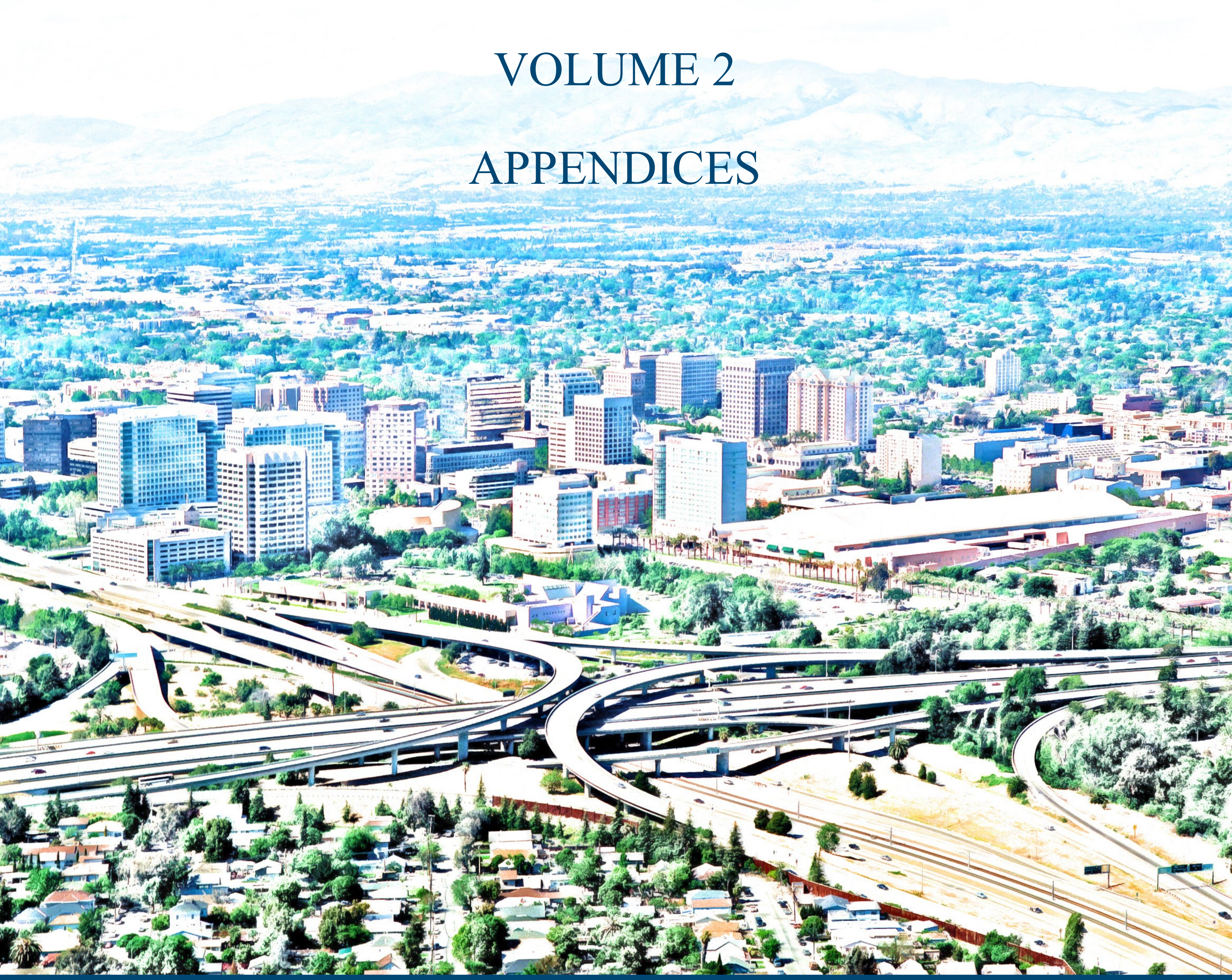
CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

SOUTH BAY WATER RECYCLING

Strategic and Master Planning

VOLUME 2

APPENDICES



RMC water and environment in association with CDM Smith

December 2014

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CITY OF
SAN JOSE
CAPITAL OF SILICON VALLEY

Santa Clara Valley
Water District

South Bay Water Recycling
Strategic and Master Planning

Appendices

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December 2014

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Appendix 1A - SBWR Visioning Report

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SBWR Strategic and Master Plan Visioning Report

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SBWR Strategic and Master Plan

The San Jose/Santa Clara Water Pollution Control Plant, in partnership with the Santa Clara Valley Water District (SCVWD), is preparing Strategic and Master Planning (Strategic Plan or Plan) documents for the South Bay Water Recycling (SBWR) system[1]. The Strategic and Master Plan has a 20-year planning horizon and will identify the purpose and future for SBWR and how SBWR will address the regulatory needs of the San Jose/Santa Clara Water Pollution Control Plant (SJ/SC WPCP or Plant) as well as regional recycled water demands. The Plan will evaluate policies for equitable, effective, and efficient allocation of costs, appropriate representative and effective governance. In addition, the Plan will evaluate alternatives for future recycled water use and include near and long-term project

The SBWR Recycled Water Master Plan Task Advisory Steering Committee (TASC), consisting of representatives from the Cities of San Jose and Santa Clara (the Plant Owners), West Valley Sanitation District (the tributary agencies' representative), and the Santa Clara Valley Water District provides management and input to the Strategic Planning effort. Recognizing the importance of articulating a collective vision for the future of SBWR, the TASC determined that the Plan's first Service Order would focus on refining the vision for the Strategic Plan. The visioning process builds upon the work previously completed by the TASC and sets the stage for development of the institutional and technical components necessary to complete the Strategic Plan.

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[1] See Appendix A for a description of the existing SBWR system and facilities.

Table 1: Participants in the Visioning Process

Name	Affiliation
TASC Members	
Kerrie Romanow	City of San Jose Environmental Services Department (ESD)
Chris de Groot	City of Santa Clara
Jon Newby	West Valley Sanitation District
Jim Fiedler	SCVWD
Joan Maher	SCVWD
Hossein Ashktorab	SCVWD
Staff Members	
Ken Davies	ESD
Karen McDonough	ESD Sustainability and Compliance Division
Rene Eyerly	ESD Sustainability and Compliance Division
Dave Tucker	ESD
Joanna de Sa	ESD WPCP Operations

The visioning process was based around three TASC workshops held between October 2012 and February 2013. The information and discussions from the workshops were summarized and analyzed for areas of agreement and divergence between wastewater and water supply interests. This Visioning Report summarizes the work completed and the decisions made through the visioning workshop. The Report is intended to help future team members who are responsible for the implementation of SBWR to understand the framework for the decisions that have been made and the resulting next steps in the

Review of Past Collaborative Efforts

The WPCP and Santa Clara Valley Water District have a history of recycled water collaboration and the current Strategic Plan is a continuation of those efforts. Collaborative efforts date back to the early

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[2] See Appendix B for a description of past collaborative efforts

- Reclamation Reuse for Groundwater Recharge study – This study was jointly funded by the WPCP and SCVWD.
- Title XVI funding - In 1992, the WPCP and SCVWD secured federal authorization through the US

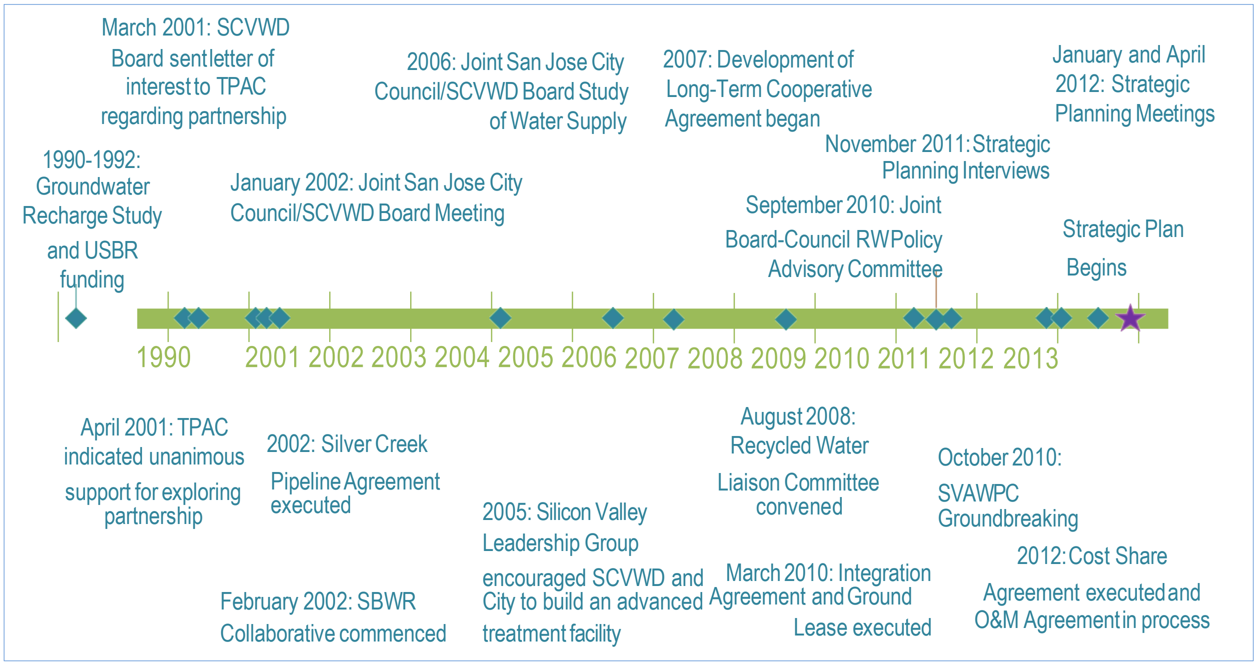
The SBWR Collaborative, which was initiated in 2002, led to the long-term agreements currently guiding WPCP and SCVWD collaboration. The SBWR Collaborative established objectives that it considered relevant to the ownership of the SBWR system and concluded that:

- It is advantageous for the WPCP and SCVWD to work together to maximize recycled water beneficial uses.
- Enhancing the quality of recycled water is key to increasing beneficial uses.
- The status quo was not working and a long-term agreement between the WPCP and SCVWD was

The SBWR Collaborative was the prompt for the formation of the Recycled Water Liaison Committee, which was comprised of WPCP and SCVWD elected officials who were tasked with negotiating terms of a long-term agreement. In 2010, the WPCP and SCVWD executed the Integration Agreement and Ground

- Key terms of the Integration Agreement are the formation of a Recycled Water Policy Committee (RWPAC) that meets in April of each year to discuss budget and operations, cost sharing, grant opportunities, expansion opportunities for non-potable and advanced treatment facilities, and changes to wholesale and retail of recycled water; the formation of Technical Working Groups comprised of staff from the Cities of San Jose and Santa Clara and SCVWD as needed to advise the RWPAC; the WPCP's contribution to advanced water treatment (AWT) and SCVWD's contributions to SBWR operations.
- Key terms of the Ground Lease and Property Use Agreement are the reservation of land at the San Jose/Santa Clara Water Pollution Control Plant (Plant) for AWT, the sizing of the AWT at 10 mgd of microfiltration and 8 mgd of reverse osmosis, water quality provision of 500 mg/L TDS

Figure 1: History of Recycled Water Collaboration


March 2001: SCVWD Board sent letter of interest to TPAC regarding partnership
2006: Joint San Jose City Council/SCVWD Board Study of Water Supply
2007: Development of Long-Term Cooperative Agreement began
January and April 2012: Strategic Planning Meetings
1990-1992: Groundwater Recharge Study and USBR funding
January 2002: Joint San Jose City Council/SCVWD Board Meeting
November 2011: Strategic Planning Interviews
September 2010: Joint Board-Council RW Policy Advisory Committee
Strategic Plan Begins
1990
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
April 2001: TPAC indicated unanimous support for exploring partnership
2002: Silver Creek Pipeline Agreement executed
August 2008: Recycled Water Liaison Committee convened
October 2010: SVAWPC Groundbreaking
2005: Silicon Valley Leadership Group encouraged SCVWD and City to build an advanced treatment facility
March 2010: Integration Agreement and Ground Lease executed
2012: Cost Share Agreement executed and O&M Agreement in process
February 2002: SBWR Collaborative commenced

In late 2011 representatives of the WPCP, SCVWD, and the tributary agencies participated in a strategic planning initiative. The initiative included two facilitated workshops in January and April of 2012 to review topics of discussion, areas of agreement, and eventually develop the Request for Proposals for the SBWR Strategic and Master Plan. The members of that initiative are now members of the SBWR Recycled Water Master Plan Task Advisory Steering Committee (TASC) that functions as the advisory committee for completion of the Strategic Plan. The following table summarizes the key topics for

Table 2 Topics Discussed at 2012 SBWR Strategic Planning Workshops

Key Topics of Discussion
January 2012 Workshop
Costs, Revenue, Cost Recovery, and Services for the Current System
Roles and Responsibilities Related to Wastewater Management versus Recycled Water Production/Distribution
Understanding and Allocating System Value
Potential Future Approaches for Expansion of Recycled Water Supply
Technical Issues
April 2012 Workshop
Issues and Options for Greater Operational Coordination between the District and SBWR
Principles to Guide Strategic and Master Planning
Master Planning Paths and Alignment
Initial Task Order

Note: See Appendix B for more details on the Initiative's 2012 workshops.

Recycled Water Opportunities and Constraints

The Strategic Plan visioning workshops provided an opportunity to discuss recycled water opportunities and constraints from both the water supply and wastewater treatment perspectives. Those discussions

Water Supply Perspective

SCVWD prepared a Water Supply and Infrastructure Master Plan (WSIMP) to look at various strategies with different mixes of water supplies. The result of that effort is that in average weather year conditions, SCVWD has sufficient water supplies through 2035. However, in drought years water supply reliability is challenged, and recycled water serves a key role in ensuring a reliable water supply. SCVWD has a goal of expanding water recycling to meet at least 10% of the countywide demand by 2025. It

SCVWD is looking at recycled water opportunities countywide, and non-potable recycled water use still has room to grow at the countywide level. In addition to the SBWR Strategic Plan SCVWD is evaluating regional recycling with the South County Regional Wastewater Authority and have begun conversations

The existing SBWR non-potable recycled water system delivers approximately 10,000 AFY and represents a quarter of a billion dollar investment. SCVWD's projections, which more than double the current use, would be a substantial investment, especially considering that "low hanging fruit" areas of non-potable use have already been captured. There is also concern that non-potable expansion into the unconfined zone of the groundwater basin could result in impacts to groundwater quality. Additionally, the growth of non-potable recycled water use in SBWR is less than was historically projected.

Indirect potable reuse (IPR) is a locally controlled source of water that represents the next step for expanding recycled water use. IPR would have a wider customer base and would eliminate concerns with non-potable irrigation over the groundwater basin. SCVWD invested in the SVAWPC to mitigate concerns of using non-potable recycled water for irrigation in areas outside the confined zone of the ground water basin, to expand non-potable uses and to have a demonstration facility for treatment

Wastewater Treatment Perspective

The original driving force for developing the SBWR system was SJ/SC WPCP's NPDES permit which limited the volume of effluent discharge during the summer due to concerns over conversion of salt

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[3] Streamflow augmentation has been part of past considerations by SCVWD, but is not expected to be a major part of SCVWD's current water supply plan, although it will be briefly evaluated in the Strategic Plan.

marsh habitat to fresh water habitat. The current NPDES permit has flow triggers starting at 115 mgd of effluent flow; at 120 mgd the permit requires completion of additional studies. At the time when the flow trigger was added to the NPDES requirements the City of San Jose had a strong desire to grow and not be encumbered by flow limitations. That was the original impetus for SBWR and the WPCP's

The importance of the NPDES flow limits as a driver for SBWR expansion has decreased in recent years due to:

- The plant influent flows have not increased for several years. Due to conservation and the exodus of some high-water use industries, the per capita water use has been decreasing.
- The Regional Water Quality Control Board is recognizing the environmental benefit of continued discharge of fresh water to the South Bay and may consider a minimum required discharge

Since the completion of the SJ/SC WPCP Master Plan, the Cities of San Jose and Santa Clara have been advised that there is no legal driver for continued expansion of SBWR. Although the current NPDES permit stipulates that recycled water use has to be maintained, and the system needs to remain in operation to fulfill customer commitments and bond requirements, there is no driver to expand the system. The WPCP reiterated that expansion of the SBWR system cannot be funded by the wastewater

For IPR projects, which would generate a concentrate (brine) stream from the reverse osmosis process, SJ/SC WPCP is concerned that the RO concentrate could negatively impact plant operations and compliance. If concentrate is sent to SJ/SC WPCP's serpentine chlorine disinfection channel just upstream of the sampling point, there is concern that there won't be sufficient blending and there could be concentration-based NPDES limits and toxicity issues. If it is sent to the headworks, there are treatment concerns. With the limits placed on the SVAWPC in the O&M Agreement, the 8 mgd RO

SJ/SC WPCP rate payers currently bear multi-million dollar losses each year for SBWR. SCVWD used to pay $115 per acre-foot of SBWR recycled water. The basis for the $115 was SCVWD's avoided cost of pumping imported water into the valley. SCVWD no longer pays an acre-foot contribution to SBWR because SCVWD's investment in the SVAWPC is now considered SCVWD contribution to the recycled water system. From the wastewater treatment agencies' perspective, in most recycled water settings, water suppliers bear the burden of recycled water subsidies as it provides "insurance" for supply reliability. In the case of SBWR, the wastewater partners have provided the subsidy to date due to the

Master Planning Expectations

The visioning workshops resulted in the following guidelines/expectations that need to be considered during development of the Strategic Plan

1. Recognize that there is no legal driver for continued expansion of SBWR.
    - From the Plant's perspective there is no need to expand. The WPCP's interest is in maintaining the non-potable system as needed to meet current NPDES permit (e.g. flow and mass limits) and to expand only if the NPDES permit changes or if there is revenue
2. The Plan should eliminate SBWR operating losses.
    - The Cities of San Jose and Santa Clara and TPAC adopted findings of the City of San Jose's audit, which included a recommendation to bring SBWR to a financial breakeven point. The WPCP had already implemented a no expansion policy in the fall of 2012; the audit merely confirmed the policy already in place. Only SBWR (not the WPCP) is operating at a loss, and there is concern over Proposition 218 implications. The Plant can charge for cost recovery but cannot subsidize a water recycling program with rates from people who do not benefit. Options for addressing the audit findings are being
3. The cost of recycled water should be shared proportionally across all who benefit.
    - The definition of benefits is something that will be developed through the master planning work, and allocation of costs will be developed through the financing strategies work
4. From the water supply perspective, the goal is to meet at least 10% of the countywide demand through water recycling by the year 2025.
    - Expansion of the non-potable system alone is unlikely to fulfill that goal; indirect potable reuse is expected to be a significant factor in meeting the 10% goal by 2025.
5. The alternatives that are developed must balance the needs of both the water supply and wastewater treatment perspectives.
    - One perspective on the ideal system expansion would be to expand in a way to meet both the Plant and SCVWD's timelines, minimizing the combined capital investment and creating an economically competitive commodity for industry and residents. The facilities would involve the minimum infrastructure necessary to meet overall goals for

Recycled Water Targets and Planning Horizon

There have been a number of recycled water planning documents in the last five years, each with varying information on the recycled water target volume and planning horizons. Some of the prior

Table 3: Prior Recycled Water Use Targets

Source	Volume	Target Date	Types of Use
WSIMP – Non-potable[1]	30,000 AFY (27 mgd)	2035	• Irrigation • Industrial
WSIMP – IPR[1]	20,000 AFY (18 mgd)	2030	• Groundwater Recharge
SJ/SC WPCP Master Plan[2]	(61,600 AFY) 55 mgd	2040	• Irrigation • Industrial • Streamflow Augmentation • Groundwater Recharge
Green Vision[3]	(45,000 AFY) 40 mgd	2022	• Irrigation • Industrial • Streamflow Augmentation • Groundwater Recharge
SCVWD Recycled Water Target[4]	40,000 AFY (36 mgd)	2025	• Not specified

Table 3 Notes:

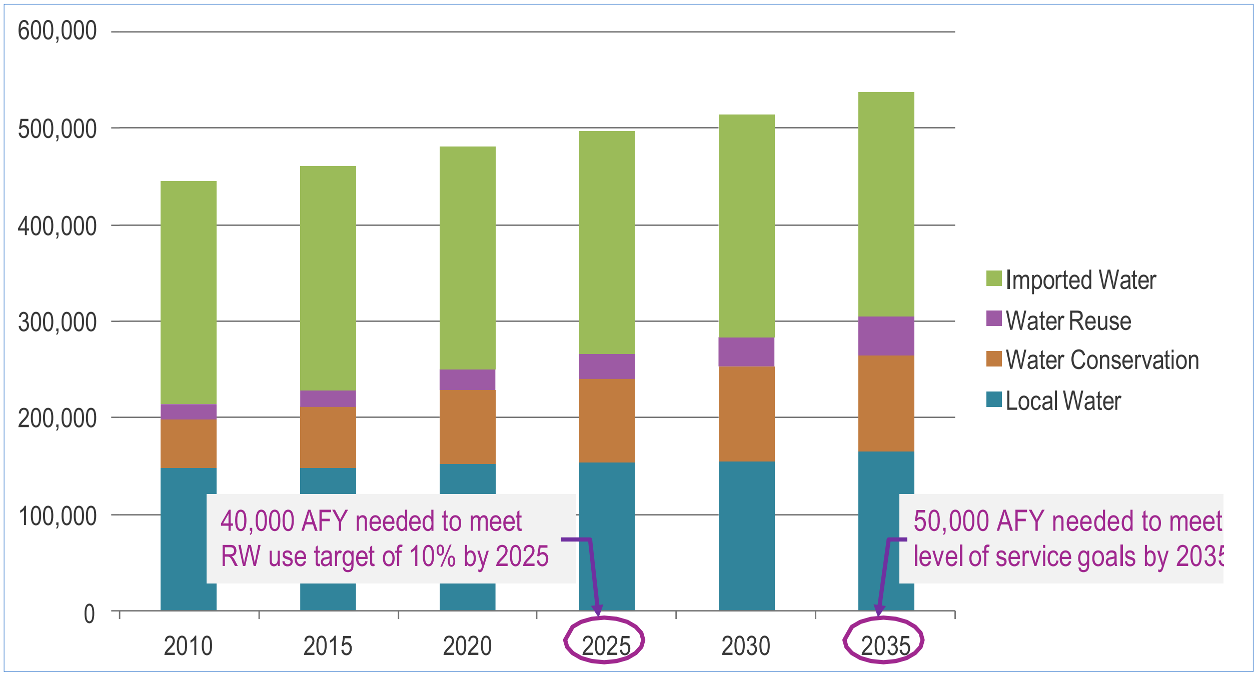
1. *Water Supply and Infrastructure Master Plan (SCVWD, 2012) assumes that recycled water supplies will continue to be a component of SCVWD's baseline supplies and calls for increases in reuse beyond the baseline projections. The WSIMP assumes that non-potable recycled use will increase to 30,000 AFY by 2035, and that at least 20,000 AFY of advanced treated recycled water will be available for groundwater recharge by 2030.*
2. *The Summary of Historical and Projected Water Reuse Demands Memorandum in the San Jose/Santa Clara Water Pollution Control Master Plan (Carollo, 2009) assumed that the water recycling through SBWR would expand to support the City's Green Vision and SCVWD water supply needs. It was assumed that the nonpotable recycled water system would continue to grow at a rate of 0.7 mgd per year and that streamflow augmentation and groundwater recharge would account for 10 mgd of reuse by 2040.*
3. *San Jose's Green Vision (City of San Jose, 2007) set a goal of beneficially reusing 100%, or approximately 100 mgd, of the City's wastewater by 2022. This goal is anticipated to be met through increased recycled water use and confirming environmental benefits of discharges to the South Bay ecosystem. In conjunction with SCVWD, the City intends to meet the recycled water component on the goal by increasing water recycling from the SJ/SC WPCP to 40 mgd of average daily recycled water use by 2022.*
4. *SCVWD has committed to expanding the use of local supplies including recycled water to reduce reliance on imported supplies. The District has a target of increasing recycled water supplies to provide at least 10% of county wide water supplies by 2025.*

In Visioning Workshop Number 3, these varying targets were discussed from both the water supply and wastewater perspectives as follows:

Water Supply

SCVWD has a goal of expanding recycled water to at least 10% of countywide water supply by 2025. At current countywide recycled water production of 15,000 AFY and projected 2025 supplies of 40,000 AFY, "level of service" goals of meeting 100% of average annual water demands in non-drought years and at least 90% of average annual water demands in drought years. To meet its drought year "level of service" goal under 2035 demands, the SCVWD's WSIMP assumes 50,000 AFY of recycled water will be

Figure 2 Recycled Water Targets from Water Supply Perspective

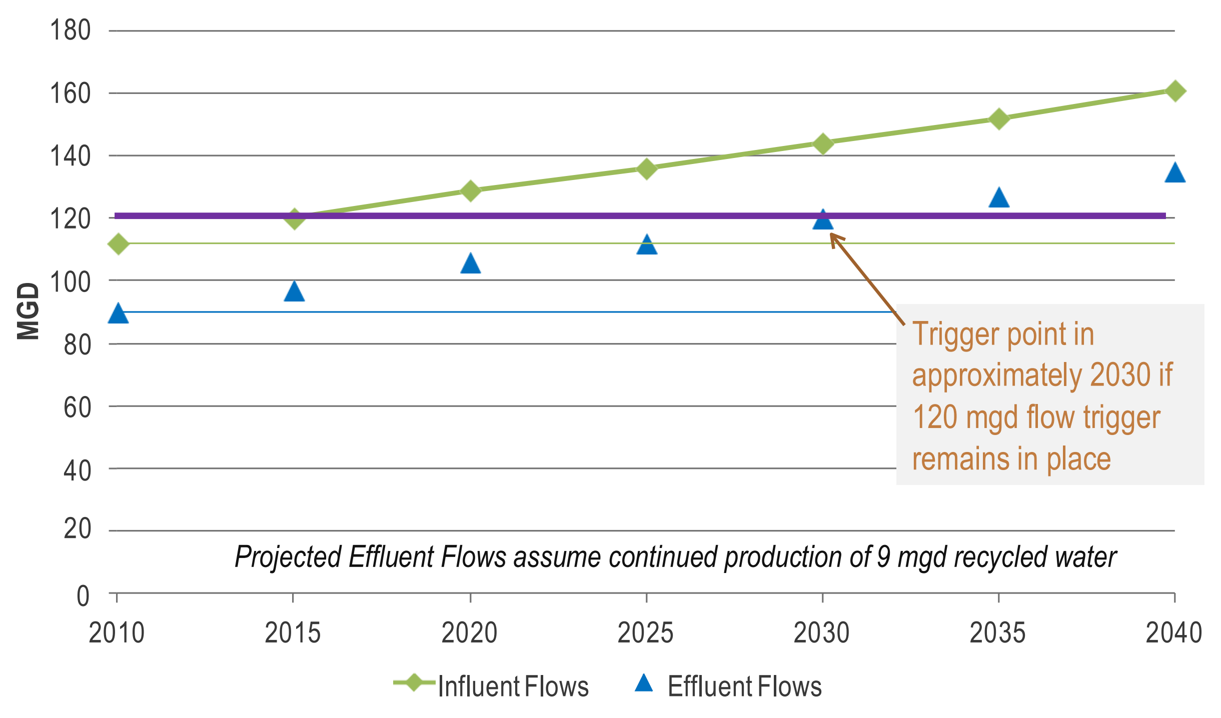


Note: Figure shows average water supplies.

Wastewater Treatment

In the near-term the WPCP will maintain its recycled water service to existing customers. In the long-term, the WPCP would need to increase recycled water production in approximately 2030, assuming that a) there is still a regulatory driver for wastewater diversion from the South Bay and b) the wastewater flow increases at the rate shown in the 2009 SJ/SC WPCP Plant Master Plan

Figure 3 Recycled Water Targets from Wastewater Perspective



Trigger point in approximately 2030 if 120 mgd flow trigger remains in place

Projected Effluent Flows assume continued production of 9 mgd recycled water

Strategic Plan Target

The TASC agreed to establish targets for water recycling based on the SCVWD's planning. While the SCVWD plans to meet its recycled water targets with sources throughout the county, for planning purposes the SBWR master planning targets assume that SCVWD's additional recycled water needs will be met by the SJ/SC WPCP. It is assumed that any near- or long-term wastewater flow diversion needs

The SBWR Strategic Plan recycled water targets and planning horizons are as follows:

Table 4: Strategic Plan Recycled Water Targets and Planning Horizons

	Year	Recycled Water Target
Near Term	2025	additional 25,000 AFY *(for a total of 40,000 AFY)*
Long Term	2035	additional 10,000 AFY *(for a total of 50,000 AFY)*

Framework Alternatives for Strategic Plan

The Strategic Plan will evaluate the following three overall framework, or thematic, alternatives:

- Maximize non-potable reuse
- Maximize potable reuse, and
- Optimize non-potable and potable

Each framework alternative has several subalternatives.

- Non-potable reuse can be met by infill in the existing service area, expansion to new service areas and regional interties[4].
- Potable reuse can be met through indirect potable reuse (IPR) or direct potable reuse (DPR), both of which can be accomplished through a centralized treatment facility or satellite treatment facilities.
- IPR can be divided into groundwater recharge alternatives and surface water augmentation. Given the difficulty of permitting surface water discharge projects, the surface water augmentation option is expected to be eliminated from further consideration during the Market Assessment phase of work.
- DPR can be divided into alternatives that connect to the raw water supply upstream of a water treatment plant and alternatives that connect directly to the potable distribution system. To date SCVWD has only considered DPR via connection to the raw water system, and the consultant team is not recommending consideration of direct

Streamflow augmentation will be considered since that alternative is included in the USBR agreement which is funding a portion of the Strategic Plan, but as with IPR via surface water augmentation, it is expected to be eliminated due to the regulatory burdens associated with surface water discharges.

The framework alternatives and subalternatives to be investigated in the Strategic Plan are depicted in

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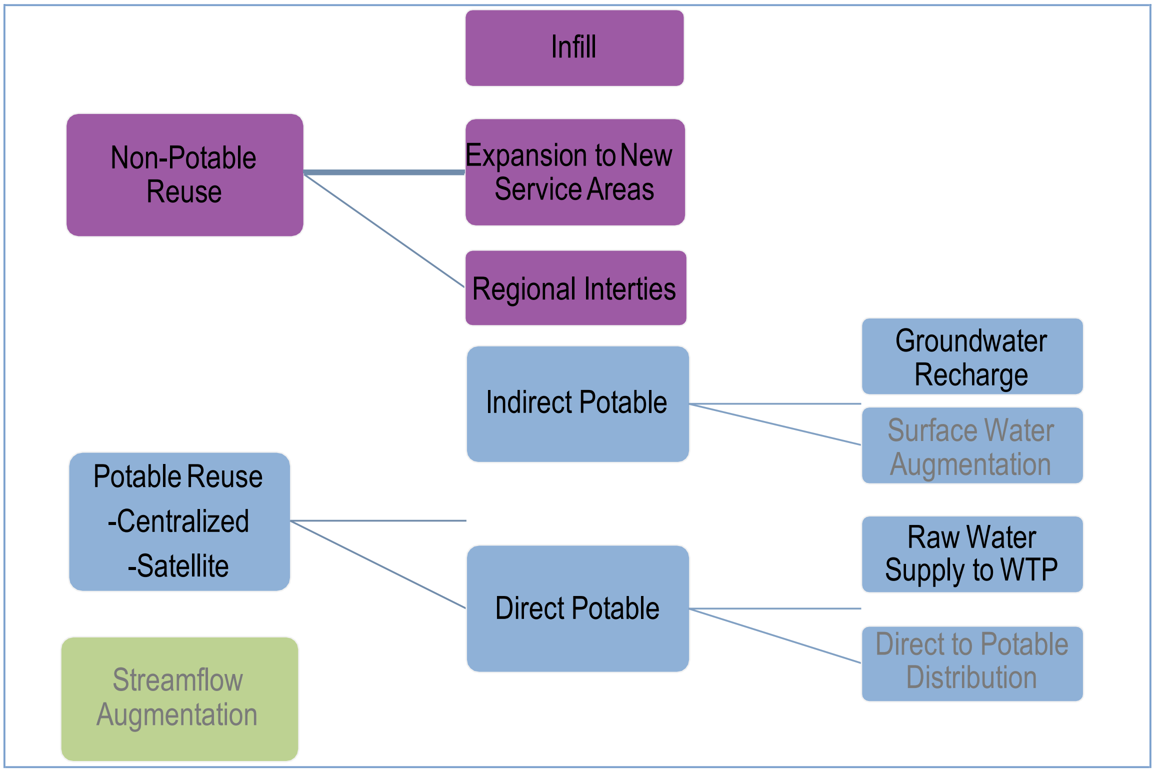
[4] The TASC expressed some reservations about the concept of regional interties. It should be considered only if a) it increases the county-wide water supply as opposed to just serving the same customers with a different source of recycled water, b) there was no degradation in SBWR water quality as a result and c) there was a clear allocation of costs in proportion to benefits, i.e. adjoining areas shouldn't benefit from the investment the WPCP has made in

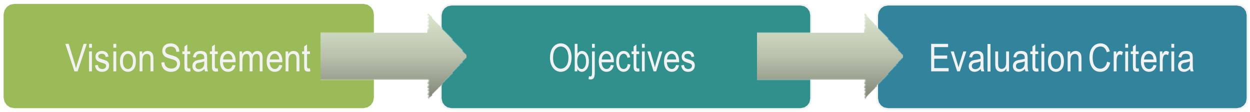
Figure 4 Framework Alternatives



Evaluation Process

Workshop 3 established the Strategic Plan Vision, Objectives, and Criteria which will be used as a guide to develop and evaluate the recycled water alternatives. The Objectives flow from the Vision and the

Figure 5 Development of Evaluation Process



Strategic Plan Vision Statement

The draft Vision Statement was developed in Workshop 1, refined in Workshop 2, and then finalized by the TASC in Workshop 3. It reflects a joint commitment to coordinate and cooperate in the development of recycled water originating from the WPCP, while still acknowledging the separate and district perspectives of the water supply and wastewater treatment entities.

The SBWR Strategic Plan Vision Statement is as follows:

The San Jose/Santa Clara Water Pollution Control Plant partner and tributary agencies and the Santa Clara Valley Water District will coordinate and cooperate to achieve the most cost effective, environmentally beneficial use of recycled water to meet the separate and distinct interests of wastewater treatment and water supply.

Strategic Plan Objectives

The objectives for the Strategic Plan were developed by the TASC in September 2012 from the Water Supply and Wastewater Treatment perspectives. Those objectives are shown below in Table 5

Table 5 TASC Objectives for the Strategic Plan

Strategic Plan Objectives	Policy or Directive
Water Supply Perspective	
Expansion of recycled water to provide sustainable water supply. Ability to expand to new nonpotable customers, both within and outside SBWR service boundary Advanced recycled water expansion for potable reuse,	Board policy (E-2.1.4): Protect, maintain and develop recycled water. Specific recycled water target = at least 10% of County demand by year 2025. State legislation (2009 Reform Act) calls for reducing future reliance on the Delta.
Protection of groundwater resources as recycled water is used and expanded.	Board policy (E-2.1.1.): Aggressively protect groundwater from the threat of contamination
Ownership and institutional arrangements that secure future recycled water development. Future assets for indirect potable reuse will be owned by the District.	Board policy (E-2): There is a reliable, clean water supply for current and future generations. Water Supply Master Plan preferred strategy calls for County's future water needs through water use
Reliable, cost-effective operation to meet current and future SBWR customer needs, generate revenue.	District Strategy S 2.1.4.3 from the Board's Governance Policy "Manage, operate and maintain recycled water assets to maximize reliability, to minimize life cycle costs and
Minimize risk for NPDES permit violations associated with water recycling.	Regulatory Requirement
Securing necessary permit(s) requirement for recycled water expansion including RWQCB and CDPH.	Regulatory Requirement
Minimize environmental impacts associated with recycled water use and expansion.	Board policy (E-1.3): "A net positive impact on the environment is…reflected in all that we do." Board policy (E-4.1): "Protect and restore creek, bay,
Build and leverage partnership opportunities and public support.	District Strategy S 2.1.4.1 from the Board's Governance Policy

Strategic Plan Objectives	Policy or Directive
Maximize potential to obtain state and federal grant funds. Build stakeholder and public support for IPR and DPR. Institutional structure that will support SBWR as both a land diversion and a water supply	“Develop partnerships with recycled water producers, land use planning agencies and other to expand the use of non-potable recycled water”. District Strategy S 2.1.4.2 from the Board’s Governance Policy “Develop partnerships to develop the potential for
Wastewater Perspective	
Meet wastewater permit requirements related to diversion in a cost effective, reliable manner.	Regulatory Requirement
Existing recycling infrastructure should be maintained to provide for current and future diversion needs.	Regulatory Requirement Bond Covenants
Provide wastewater treatment and disposal to accommodate projected growth as indicated in the adopted general plans of our partner agencies within	San Jose – Envision San Jose 2040 General Plan
Minimize risk for NPDES permit violations associated with water recycling.	Regulatory Requirement
Ensure Bay water and wetlands are not degraded.	Regulatory Requirement
Increase use of plant effluent to create water supply for our community and generate proceeds.	Green Vision Goal

Evaluation Criteria

Evaluation criteria were discussed as part of the visioning process since the criteria establish the range of information that must be developed for each alternative. The water and wastewater objectives established by the TASC in September 2012 were linked to the evaluation criteria proposed by the

The Strategic Plan will use two categories of evaluation criteria:

- Threshold Criteria – Criteria that do not differentiate between projects. They are the bar that all projects must meet to be considered viable and be further evaluated. For example if an alternative doesn’t meet the threshold criterion of supporting NPDES permit compliance, that alternative won’t move forward.
- Scoring Criteria – Criteria that will be weighted and used to evaluate and rank alternatives. The

The following table summarizes the Criteria and subcriteria that will be used in the Strategic Plan

Table 6 Evaluation Criteria for Strategic Plan

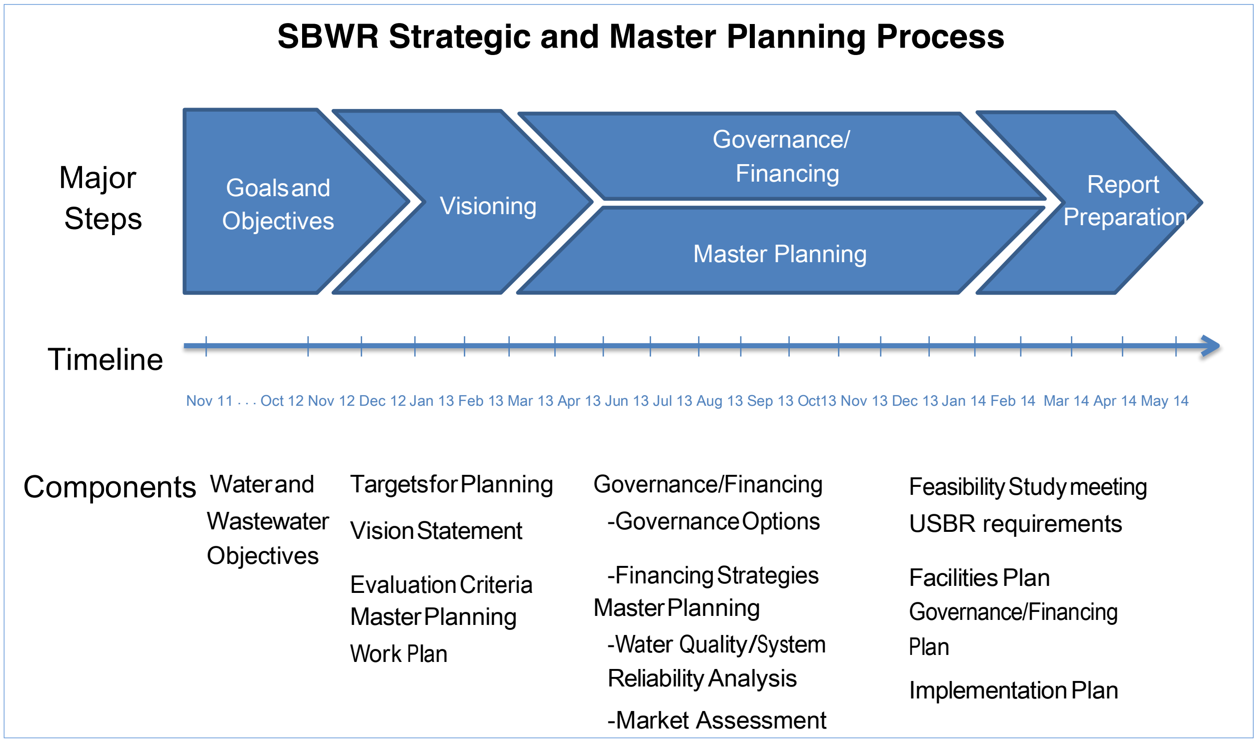
Evaluation Criteria	
Threshold Criteria	
Support NPDES permit compliance	
Protect public health	
Support regional salt and nutrient goals	
Meet existing customer supply needs	
Maintain overall recycled water TDS of 500 mg/l	
Scoring Criteria	**Sub-Criteria**
Achieve supply goals	None
Protect Groundwater quality	None
Promote cost efficiency	Total capital cost
	O&M cost
	Revenue generation potential
	Outside funding potential
Protect environment	Greenhouse gas emissions
	South Bay estuary and wetlands habitat
	San Francisco Bay quality
	Indirect environmental impacts
Implementability	Public perception
	Permitting complexity
	Phasing flexibility
	Institutional complexity
Adaptability and reliability	Flexibility in meeting future regulations
	Reliability of service/water quality to customer
	Stability of demand

During the next phase of the Strategic Plan the TASC will develop the metrics used to measure each alternative's performance in relation to each criteria and will also develop the relative weighting of the criteria

Strategic Plan Scope

This report concludes the Visioning stage of the Strategic Plan. Work will now focus on evaluation of Governance/Financing, Master Planning, and development of the Feasibility Study as shown below

Figure 6 Strategic Plan Phases of Work



The next phase of the Strategic Plan will take place under Service Order 2 and includes the following tasks.

Table 7 Strategic Plan Task List

Task	Description
1	Governance and Finance
2	Water Quality and System Reliability
3	Market Development
4	Regional Opportunities
5	Capital Projects Development
6	Report Preparation and Coordination

Attachments

Appendix A: SBWR Background Information

Appendix B: Summary of Past Collaborative Efforts

Appendix A
SBWR Background Information

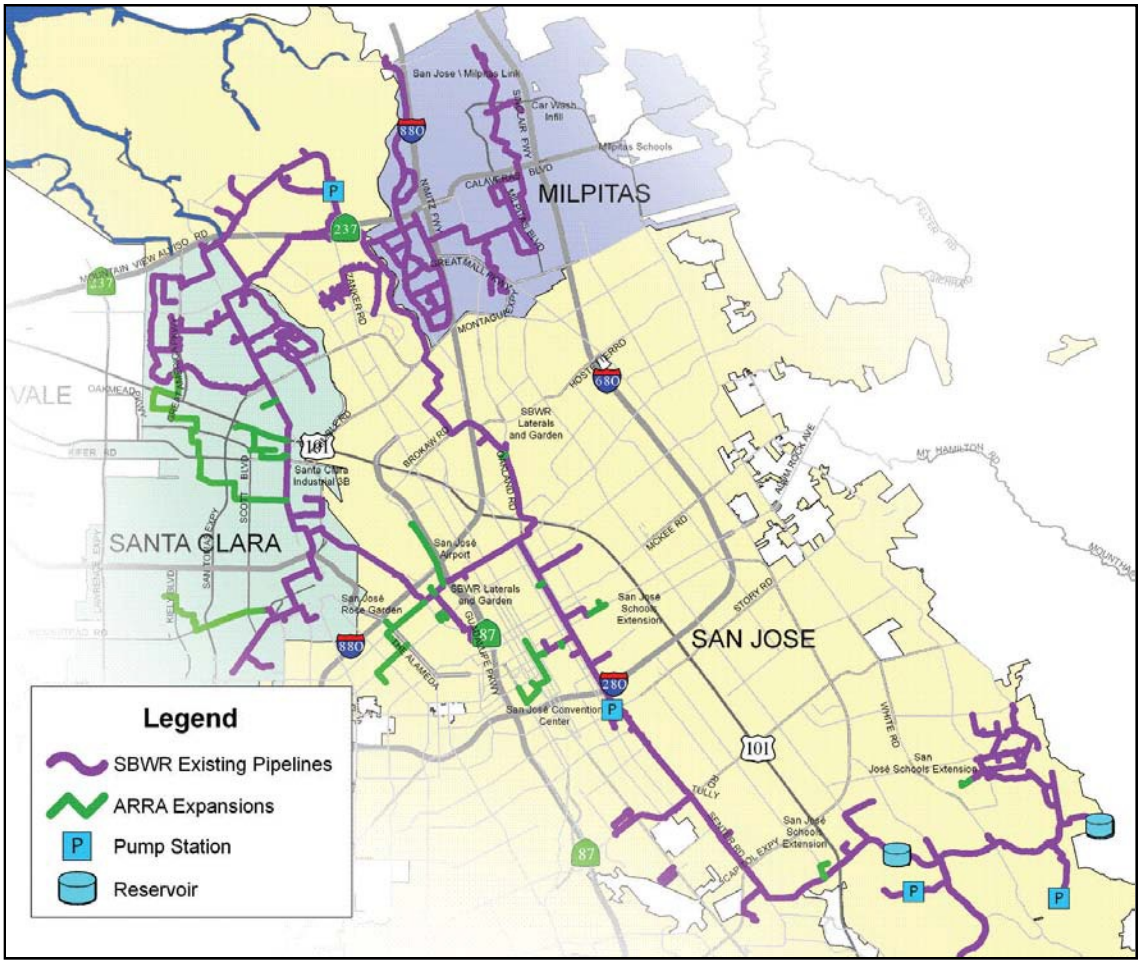
System Overview

South Bay Water Recycling (SBWR), the largest recycled water program in northern California, is the division within the City of San José's Environmental Services Department (an authorized Reclamation Title XVI project partner) that is responsible for the distribution and wholesale of recycled water generated by the San Jose/Santa Clara Water Pollution Control Plant (WPCP or Plant). The Plant is a regional wastewater treatment facility serving the cities of San José and Santa Clara, the Plant's co-owners, and the cities of Milpitas, Campbell, Cupertino, Los Gatos, Saratoga, and Monte Sereno, who

The current SBWR distribution system receives disinfected effluent from filters optimized exclusively for Title 22 recycled water production at the transmission pump station (TPS) on the Plant lands. From TPS, the recycled water is distributed in 130 miles of pipelines ("purple pipes") throughout San José, Santa Clara, and Milpitas, delivering approximately 10,000 acre-feet per year (AFY) or 9 million gallons per day (mgd), which accounts for about 2 percent of the regional water use in Santa Clara County. Peak flows in the dry summer months can exceed 20 mgd. Approximately 620 customers use recycled water for a variety of uses including industrial cooling, landscape irrigation and dual plumbing of buildings. Treated wastewater not delivered by SBWR, currently more than 80,000 AFY (70 MGD), is discharged into the

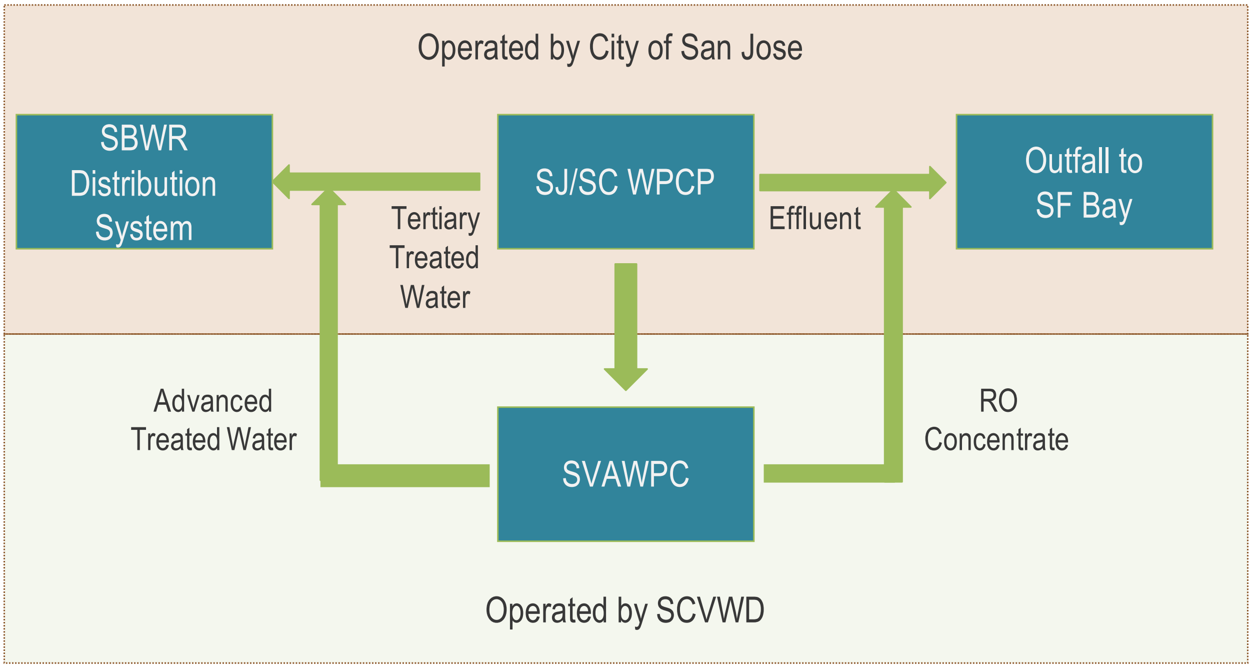
SBWR, along with water conservation and reduction in infiltration and inflow, was a remedy prescribed in the South Bay Action Plan to reduce Plant effluent flows to protect the salt marsh habitats of the South San Francisco Bay. The Plant's NPDES permit limits the dry weather effluent discharge to the Bay at 120 mgd. Should the Plant exceed this maximum effluent flow trigger, the City of San José, the City of Santa Clara, and the tributary agencies could be subject to a sewer hookup moratorium, which would effectively stop growth in the South Bay cities. While the SBWR program was built as a water diversion project for the Plant, recycled water has become a major component of the Santa Clara Valley Water

Figure A-1 Existing SBWR Distribution System



To help facilitate this increase in recycled water use, the District has partnered with the City of San José to build the Silicon Valley Advanced Water Purification Center (SVAWPC) on the Plant lands to produce recycled water with fewer total dissolved solids (TDS) than current SBWR supplies. The SVAWPC, which will be operated by SCVWD, will take secondary treated effluent from the Plant and treat it with microfiltration and reverse osmosis. The SVAWPC process will then apply ultraviolet disinfection and blend the SVAWPC product water with the current Title 22 recycled water, and thereby enhancing the quality of recycled water distributed by SBWR. Lowering the TDS of recycled water will open up more areas within Santa Clara County for recycled water use. The SVAWPC includes a 2.25 million gallon

Figure A-2 SVAWPC Operational Schematic



The SBWR system has expanded in several phases and continues to receive funding for expansion through grants from the US Bureau of Reclamation's American Recovery and Reinvestment Act (ARRA), WaterSMART 2011, and the California Department of Water Resources' Proposition 84

Major Challenges

SBWR staff and recycled water customers experience with the system has led to a better understanding about the challenges facing the recycled water production and delivery system that have changed from SBWR inception 19 years ago

Water Quality (San Francisco Bay and Recycled Water)

SBWR currently uses a significant portion of the Plant's effluent. While the Plant has discharged less than 120 mgd (the regulatory trigger defined in its NPDES permit) to Artesian Slough in the summer months for over 10 years, there is little knowledge on the impact to water quality (particularly dissolved oxygen) and South Bay habitats that may result from further effluent reductions or zero discharge to the

The SVAWPC is designed to address not only TDS but also contaminants of emerging concern (CECs) such as NDMA, a by-product that results from chlorine disinfection. Nevertheless, the current facility is designed primarily to blend the filtered effluent with the product from the SVAWPC. Due to this

Economic Viability

Currently SBWR operations are subsidized by San Jose and Plant Tributary Agency sewer rate payers. Further expansion of SBWR cannot be funded by sewer rate payers. Cost recovery and potentially a return on investment will be part of the analysis for the existing recycled water system, and the outcome may require developing a new business plan. Financial (including wholesale and retail rate evaluation) and operational analyses (including existing system rehabilitation and maintenance) will be necessary to support consideration of a new business model for the existing SBWR system. Further, in the next two years, SBWR and District costs for recycled water infrastructure will be shared per provisions in the “Recycled Water Facilities and Programs Integration Agreement between the City of

Governance

The Plant’s governing structure, the Treatment Plant Advisory Committee (TPAC) and the City of San José Council, make policy and budget decisions related to SBWR, prioritizing the interests and needs of the Plant and sanitary sewer rate payers of San Jose, Santa Clara, and the Tributary Agencies. Since the Plant’s effluent to the Bay is significantly lower than the 120 mgd trigger in the dry-weather months, there is no regulatory mandate to increase effluent diversion from the Bay through SBWR system expansion. In March 2010 San Jose City Council approved the Integration Agreement between the City and the District which provided a frame work for the City and District to financially and administratively support the production and use of recycled water in Santa Clara County consistent with each party’s separate and distinct interests: wastewater treatment and disposal for the City, and water quality and supply for the District, as well as to coordinate and cooperate to achieve the most cost effective,

System Reliability

Currently, SBWR experiences summer-time peaking events that result from competing customer demands on recycled water. These unpredictable events add additional strains on normal operations to meet State water quality requirements under Title 22 of the California Code of Regulations. SBWR has limited storage, as it is dependent on the continual pumping at TPS to service customers with recycled

The recycled water system, built over the past 14 years in fragments, lacks redundant loops and other reliability measures common to other water distribution systems. SBWR needs to refine its investment plan in order to maintain reliability of water deliveries and to keep operation costs down. Reliability decisions must consider customer needs and the desired level of service. In some cases level of service

SBWR has traditionally been defined as beginning at the Transmission Pump Station (TPS), but recycled water reliability also should include reliability of the upstream treatment plant processes. The NPDES permit requires the reliability of the majority of the treatment plant but does not cover portions of the

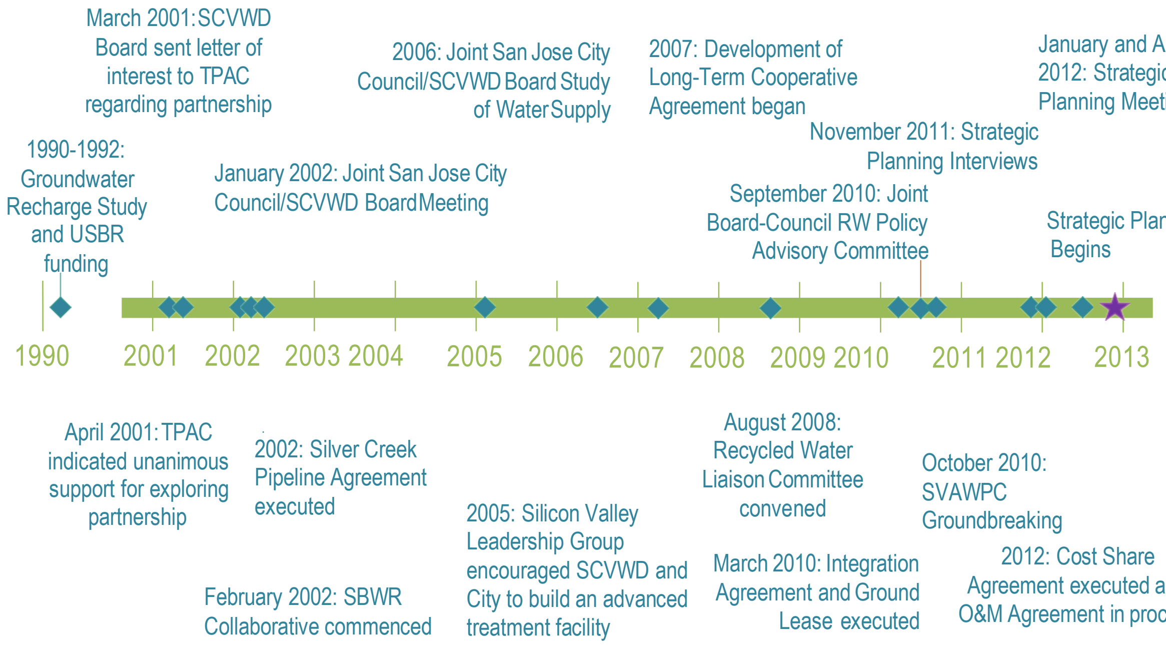
Some of the reliability issues identified by the TASC include:

- SBWR was initially designed with one reservoir. The operation has not been updated to accommodate the original reservoirs.
- The communication system needs to be updated. The communication to Pump Station 11 is through lease lines that are routinely cut. At one time SBWR tried to put timers on the system which corrupted the system, necessitating manual operation.
- Zone 1 would benefit from a reservoir that rides on the hydraulic grade line. However it is not institutionally feasible to add a reservoir.
- Constructing a pipeline from Pump Station 5 to Yerba Buena Reservoir and moving the existing customers on this alignment on the new pipeline would allow the existing pipeline to be dedicated to Zone 1.
- Controlling the pump stations based on level of tanks would reduce the effort required by SBWR operators.
- SBWR reliability improvement will need to be done in two steps – operation improvements and hardware upgrades.
- Reliability Study should focus on keeping this valuable wastewater disposal asset viable for

Appendix B
History of SBWR Collaboration

The history of recycled water collaboration between the City of San Jose and Santa Clara Valley Water District (SCVWD) dates back to the early 1990s, when the City of San Jose and SCVWD worked together on recycled water studies and funding opportunities. By 1992 The City and SCVWD had jointly funded the Reclamation Reuse for Groundwater Recharge Study and had secured federal authorization through

Figure 1 History of Recycled Water Collaboration


March 2001: SCVWD Board sent letter of interest to TPAC regarding partnership
2006: Joint San Jose City Council/SCVWD Board Study of Water Supply
2007: Development of Long-Term Cooperative Agreement began
January and April 2012: Strategic Planning Meetings
November 2011: Strategic Planning Interviews
1990-1992: Groundwater Recharge Study and USBR funding
January 2002: Joint San Jose City Council/SCVWD Board Meeting
September 2010: Joint Board-Council RW Policy Advisory Committee
Strategic Plan Begins
1990
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
April 2001: TPAC indicated unanimous support for exploring partnership
2002: Silver Creek Pipeline Agreement executed
August 2008: Recycled Water Liaison Committee convened
October 2010: SVAWPC Groundbreaking
2005: Silicon Valley Leadership Group encouraged SCVWD and City to build an advanced treatment facility
March 2010: Integration Agreement and Ground Lease executed
2012: Cost Share Agreement executed and O&M Agreement in process
February 2002: SBWR Collaborative commenced

In 2002 the City and SCVWD formed the SBWR Collaborative which included a ten-month collaborative stakeholder process to develop recommendations for an institutional framework for long-term ownership, operation, maintenance and future expansion of SBWR, including review and suggestions on water quality and cost issues. The goal of the Collaborative effort was to recommend an institutional framework that would most effectively meet the long-term water supply and wastewater discharge

The SBWR Collaborative concluded that:

1. It would be very advantageous for the City and the District to work together to ensure that recycled water can be beneficially used to the maximum extent practicable in the County.
2. Enhancing the quality of the recycled water and understanding the impact of additional uses on the groundwater basin are key to increasing the number and types of beneficial uses for

recycled water. It also increases the likelihood of meeting the following objectives for this process: (1) Aggressively protect the groundwater basin; (2) Ensure that flows stay below the 120 mgd flow trigger for discharging to the bay; (3) Ensure that recycled water is integrated into the long term reliable water supply for Santa Clara County; (4) Maximize the beneficial use of recycled water; (5) Protect the estuary and environment and maximize environmental benefits; (6) Improve the public understanding and acceptance of appropriate use of recycled water

3. Only two options for institutional arrangement beyond the status quo met the goals of the Collaborative with sufficient likelihood of success to be explored in further depth
    a) Development of a new Joint Powers Authority responsible for the recycled water system; and
    b) Development of a long-term comprehensive agreement between the Treatment Plant JPA and the District for managing and enhancing the SBWR system.

The SBWR Collaborative was the prompt for the formation of the Recycled Water Liaison Committee, which was comprised of City and SCVWD elected officials who were tasked with negotiating terms of a long-term agreement

Key Agreements between the City and the SCVWD include the following:

- Integration Agreement (2010) includes the formation of a Recycled Water Policy Committee (RWPAC) that meets April of each year to discuss budget and operations, cost sharing, grant opportunities, expansion opportunities for non-potable and advanced treatment facilities, and changes to wholesale and retail of recycled water; the formation of Technical Working Groups comprised of staff from the Cities of San Jose and Santa Clara and SCVWD as needed to advise the RWPAC; the City of San Jose's contribution to advanced water treatment (AWT) and SCVWD's contributions to SBWR operations.
- Ground Lease and Property Use Agreement (2010) includes the reservation of land at the San Jose/Santa Clara Water Pollution Control Plant (Plant) for AWT, the sizing of the AWT at 10 mgd of microfiltration and 8 mgd of reverse osmosis, the water quality provision of 500 mg/L TDS, and the 40 year term of agreement.
- Cost Sharing Agreement (2012) includes cost sharing for development of the SBWR Strategic and Master Planning effort

In 2012 representatives of the City, SCVWD, and the tributary agencies formed the SBWR Recycled Water Master Plan Task Advisory Steering Committee (TASC) to review topics of discussion, areas of agreement, and develop the Request for Proposals for the SBWR Strategic and Master Plan. The TASC continues to function as the advisory committee for completion of the Strategic Plan. The following tables summarize their 2012 meetings.

Table 1 January 26, 2012 TASC Meeting

Key Topics of Discussion	Areas of Discussion	Where Topic Integrates into Current Planning Process
Costs, Revenue, Cost Recovery, and Services for the Current System	• Current system is far from full cost recovery • Little appetite to make up the difference in cost through the use of general revenues • SBWR should pursue current efforts to reduce the operating costs of the recycled water program to improve cost recovery • In general, water users need to pay more to	• Financing Strategies
Roles and Responsibilities Related to Wastewater Management versus Recycled Water Production/Distribution	• Need to define line between wastewater treatment and recycled water supply production and distribution • Sewer districts shouldn't pay more for system expansion • Sewer districts may be willing to invest in	• Governance Options • Financing Strategies
Understanding and Allocating System Value	• Need to understand value of SBWR assets • Investigate concept of water rights and/or allocating capacity to produce recycled water to tributary agencies	• Governance Options • Financing Strategies
Potential Future Approaches for Expansion of Recycled Water Supply	• SBWR should take opportunity to identify and pursue positive, near-term return on investment opportunities • Not enough is known about customers' willingness to pay and the true costs of supplying recycled water • Need to develop a detailed financial analysis of costs and potential rates • Important to coordinate the SBWR Master	• Visioning (Potential Pathways) • Master Planning
Technical Issues	• Areas for further investigation: ○ Capital investments needed to maintain current level of service ○ Capital investments to increase reliability ○ How to assess value of avoided cost of	• Visioning (Opportunities and Constraints, Potential

	nutrient removal and other future regulations - RO concentrate implications	• Master Planning

Table 2 April 20, 2012 Task Meeting

Key Topics of Discussion	Areas of Discussion	Where Topic Integrates into Current Planning Process
Issues and Options for Greater Operational Coordination between the District and SBWR	• SBWR recycled water could serve as a supply for SCVWD IPR or DPR • As planning moves forward, the assumptions that SCVWD and SBWR make about recycled water diversion rates need to be aligned • The supply of recycled water (and the use to which it is put) is highly dependent on the wholesale prices and SBWR diversion needs • The upcoming strategic and mater planning process	• Visioning (Opportunities and Constraints, Potential Pathways) • Master Planning • Governance Options
Principles to Guide Strategic and Master Planning	• SBWR investment decisions should be made for the benefit of the sewer rate-payers • Investments in recycled water supply should be paid by the customer, retailer, or another entity on the “demand side” • SBWR and SCVWD could consider options for selling or leasing aspects of SBWR operations in the future • SCVWD should consider the cost-effectiveness of using recycled water in light of its current infrastructure and its other water supply options	• Visioning (Opportunities and Constraints, Potential Pathways) • Master Planning • Governance Options • Financing Strategies
Master Planning Paths and Alignment	• Two potential pathways ○ Master Plan “A”: needs and costs of maintaining and operating the current plant, assuming no expansion in water supply ○ Master Plan “B”: assess IPR and DPR opportunities and scenarios based on increasing	• Visioning (Potential Pathways)
Initial Task Order	• Initial task order to include: ○ Establish basic foundational data and common assumptions about topics such as influent	• Visioning (Opportunities and Constraints,

Key Topics of Discussion	Areas of Discussion	Where Topic Integrates into Current Planning Process
	projections, and production costs ○ Identify what kind of plant technology and related mitigation activities (e.g., a brine management plan) would be needed to produce a range of recycled water volumes ○ Identify and describe optimized approaches for sourcing potable water ○ Identify and describe least-cost approaches for producing recycled water, which SCVWD would	Pathways) • Master Planning

At their September 2012 meeting the TASC developed objectives from both the water supply and wastewater treatment perspectives that would be used as guidance in formulating the Strategic Plan. These objectives are shown on the following table and are mapped to the previous objectives from the 2002 Collaborative to illustrate how the 2002 objectives have been integrated into the current planning

Table 3 Comparison of 2002 Objectives to 2012 TASC Objectives

SBWR Collaborative Objectives (2002)	Water Supply Objectives (2012)	Wastewater Treatment Objectives (2012)
Aggressively protect groundwater resources.	• Protection of groundwater resources as recycled water is used	
Ensure that recycled water is integrated into the long-term reliable water supply for Santa Clara County.	• Expansion of recycled water to provide sustainable water supply. ➢ Ability to expand to supply new non-potable customers, both within and outside SBWR service boundary. ➢ Advanced recycled	• Increase use of plant effluent to create water supply for our community and generate proceeds.

SBWR Collaborative Objectives (2002)	Water Supply Objectives (2012)	Wastewater Treatment Objectives (2012)
Protect the estuary and environment and maximize the environmental benefits of	• Minimize environmental impacts associated with recycled water use and	• Ensure Bay water and wetlands are not degraded.
Maximize the beneficial use of recycled water.	• Ownership and institutional arrangements that secure future recycled water development. ➢ Future assets for indirect potable	
Improve the public understanding and acceptance of appropriate use of recycled water supplies.	• Build and leverage partnership opportunities and public support. • Build stakeholder and public support for IPR	•
Prevent future flows from exceeding 120 mgd.	•	• Existing recycling infrastructure should be maintained to provide for current and future diversion needs. • Provide wastewater treatment and disposal to accommodate projected growth as indicated in the adopted general plans of our
Minimize the combined cost of water and wastewater to the ratepayer.	• Reliable, cost-effective operation to meet current and future SBWR customer needs,	• Meet wastewater permit requirements related to diversion in a cost effective, reliable
Provide for specific customer supply and quality needs.	• Reliable, cost-effective operation to meet current and future SBWR	•

SBWR Collaborative Objectives (2002)	Water Supply Objectives (2012)	Wastewater Treatment Objectives (2012)
	generate revenue.	
Reduce financial and institutional barriers to the use of recycled water.	• Securing necessary permit(s) requirement for recycled water expansion. (e.g. Regional Board, CDPH) • Build and leverage partnership opportunities and public support. • Maximize potential to obtain state and federal grant funds. • Build stakeholder and public support for IPR and DPR.	•
	• Minimize risk for NPDES permit violations associated with water	• Minimize risk for NPDES permit violations associated with water

Appendix 2A - RWF Influent Flow Projections

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Appendix 2A RWF Influent Flow Projections

Technical Memorandum

Title:	**RWF Influent Flow Projections Update**
Prepared by:	**Celine Monget**
Reviewed by:	**Marilyn Bailey; Tom Richardson**
Date:	**July 23, 2013**

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1. Executive Summary

The purpose of this TM is to update projected wastewater influent flows at the San José/Santa Clara Regional Wastewater Facility (RWF) through 2035 to coincide with the recycled water planning horizon. The flow projections contained in this TM will be incorporated into the SBWR Strategic and Master Plan

- Determining when/if increased wastewater diversion would be needed in response to the 115 and 120 million gallons per day (mgd) effluent flow triggers currently included in the RWF NPDES discharge permit.
- Providing an indication of the maximum amount of wastewater available for recycling purposes through 2035
- Providing input to the flow balance calculations. The influent flow projection will be needed to calculate how much flow will be discharged to the Bay under each of the various recycled water

In order to better capture possible flows variations over such a long planning horizon, RMC has developed a range of wastewater influent flow projections. A set of four wastewater influent projections were developed based on two sets of population projections for Santa Clara County and two levels of conservation through 2035. A fifth wastewater influent projection that represents the average of the four other sets is also shown for reference. Data sources for all projections sets are provided throughout the TM and are listed together in Section 5. This TM will show the full range of

The first set of population projections is based on Center for the Continuing Study of the California Economy (CCSCE)'s Projections of Jobs, Population and Households for the City of San José prepared for The Envision San José 2040 General Plan Update[Ref7]. The second set of population projections is based on the California Department of Finance Demographic Research Unit's Report P-1 State and County Population Projections[Ref9]. Population projections were modified by the percent of population in Santa Clara County estimated to be served by the RWF[Ref2] in order to develop projections of the population within the RWF service area. The first set of population projections shows a population increase ranging from 1.0 percent to 2.1 percent annually from 2012 to 2035 (see Table 3). The second set of

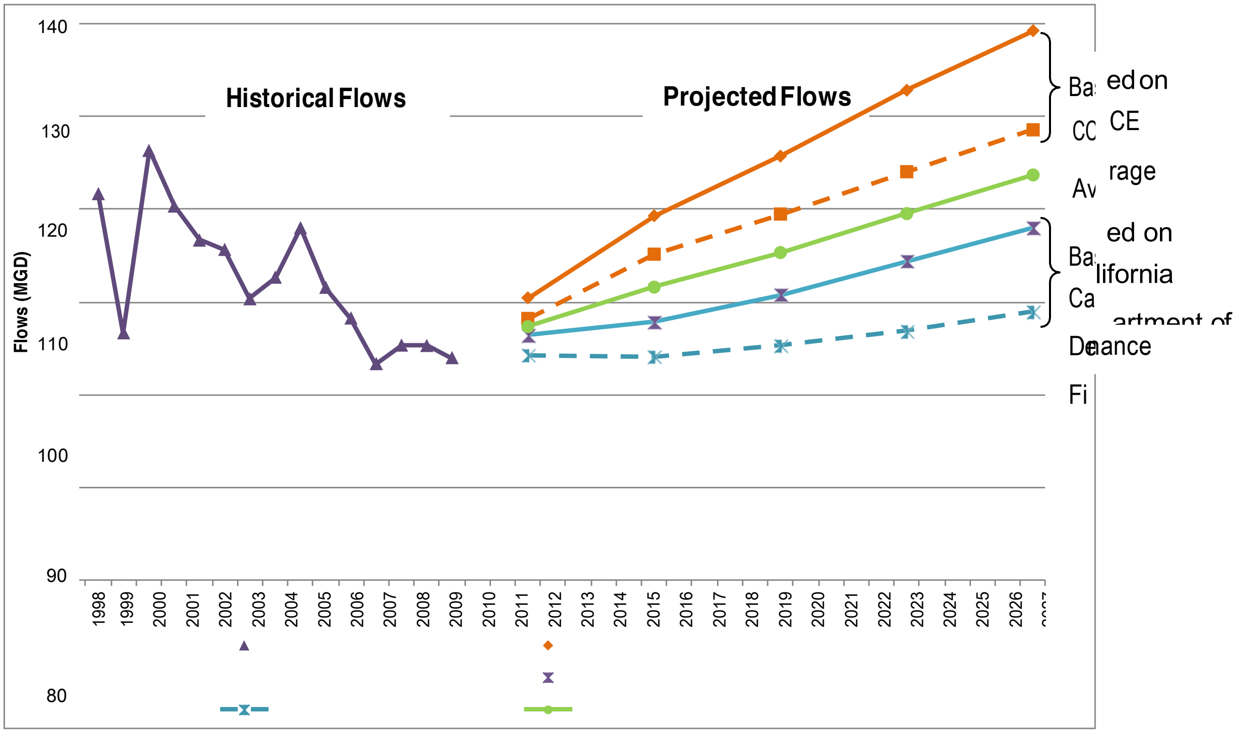
In addition, two sets of per capita average dry weather flow (ADWF) that assume different conservation levels were developed. The first set of per capita ADWF assumes that the per capita wastewater production attained in 2012 (74.7 gallons per capita per day (gpcd)) remains constant through 2035.

Valley Water District (SCVWD) 2010 Urban Management Plan[Ref4]. The second set of per capita ADWF shows a decrease in the per capita ADWF from 74.7 gpcd in 2012 to 69.0 gpcd in 2035 (See Table 5).

The two sets of population projections and two sets of average dry weather flow per capita were combined to create four different projected ADWF curves through 2035. The four ADWF curves are shown in Figure ES-1; an additional curve that depicts the average ADWF of the four ADWF curves is also shown (in green) in Figure ES-1. The maximum ADWF curve is based on CCSCE's population projections and the 2012 per capita ADWF of 74.7 gpcd (orange solid line in Figure ES-1). The maximum per capita ADWF increases from 110 mgd in 2015 to 139 mgd in 2035 (see Table 5). The minimum ADWF curve is based on the California Department of Finance's population projections and increased conservation levels (blue dotted line in Figure ES-1). The minimum per capita ADWF varies from 104

Historical flows have steadily declined between 2000 and 2005. That decline may be due to a combination of factors including increased conservation that led to a reduced per capita ADWF and a slow population increase of approximately 0.8 percent between 2000 and 2010. When using the CCSCE's population projections, the ADWF increases from 104 mgd in 2012 to 110 mgd in 2015. That increase is the result of a significant projected population increase of approximately 2.1 percent annually between 2012 and 2015 (see Table 3). When using the more conservative California

Figure ES1: Historical and Projected ADWF Flows Through 2035



2. Introduction

The San José/Santa Clara RWF, in partnership with the Santa Clara Valley Water District (SCVWD), is preparing Strategic and Master Planning (Strategic Plan or Plan) documents for the South Bay Water Recycling (SBWR) system. The Strategic and Master Plan has a planning horizon to year 2035 and will identify the purpose and future for SBWR, how SBWR will address the regulatory needs of the San

2.1 TM Purpose

This TM provides an update of wastewater flow projections initially developed as part of the 2009 Master Plan for the San José/Santa Clara Water Pollution Control Plant (now called Regional Wastewater Facility (RWF)[Ref1, Ref2, Ref3]. Findings from this TM will inform the Market Assessment and the development and evaluation of project alternatives. As mentioned in the executive summary, this TM is relevant to the SBWR Strategic and Master Planning effort as it provides an indication of the projected ADWF which in turn influences the maximum amount of wastewater that is available for

2.2 TM Background

This TM relies in part on information presented as part of the 2009 RWF Master Plan, and in particular:

- Task 3 Project Memorandum 1 - Historical Wastewater Flows
- Task 3 Project Memorandum 6 - Historical and Projected Service Area/Population
- Task 3 Project Memorandum 8 - Projected Wastewater Flows and Characteristics

Data in the RWF Master Plan is provided for 1998-2007. Data from the RWF Master Plan was supplemented by RWF wastewater flow projections through 2012 provided by the RWF[Ref10]. Population estimates through 2012 are from the California Department of Finance[Ref5] Population projections through 2035 are from the CCSCE[Ref7]or the California Department of Finance[Ref9]. Finally, conservation estimates were informed by the 2010 Urban Watershed Management Plan[Ref4] for Santa Clara Valley Water District. Wastewater flow projections through 2035 presented in this TM are based on data and

2.3 TM Organization

This TM is organized as follows:

1. Executive Summary
2. Introduction
3. Review of RWF Influent Flows (1998 -2012)
4. RWF Influent Flow Projections Through 2035

2.4 Definitions

The Average Dry Weather Flow (ADWF) is the only flow measure considered in this TM. The definition of ADWF is provided in Table 1

Table 1: Flow Definition

Term	Definition	Purpose
Average Dry Weather Flow (ADWF)	The average daily influent flow occurring over the three consecutive lowest flow months between the months of May and October.	Develop wastewater flow projections.

Notes:

1. ADWF is different from the Average Dry Weather Flow Influent Flow (ADWIF). ADWIF is the maximum of the average daily influent flow over any five weekday period between the months of June and October. ADWIF is reported for compliance with the RWF National Pollutant Discharge Elimination System (NPDES) Permit (No.CA00378842, which includes a 167 mgd limit on the ADWIF to the RWF.

3. Review of RWF Influent Flows (1998-2012)

3.1 Wastewater Influent Flow Estimates

Average influent wastewater flow data from 1998 through 2012 were collected for this analysis. As illustrated on Figure 1, monthly influent flows steadily declined from 2002 through 2012; however, monthly influent flows appear to have stabilized in recent years (2010 and 2012). Similarly, the ADWF has also declined from 1998 through 2012, as can be seen in Figure 2. As with Figure 1, Figure 2 shows

Figure 1: Monthly Average RWF Influent Flows

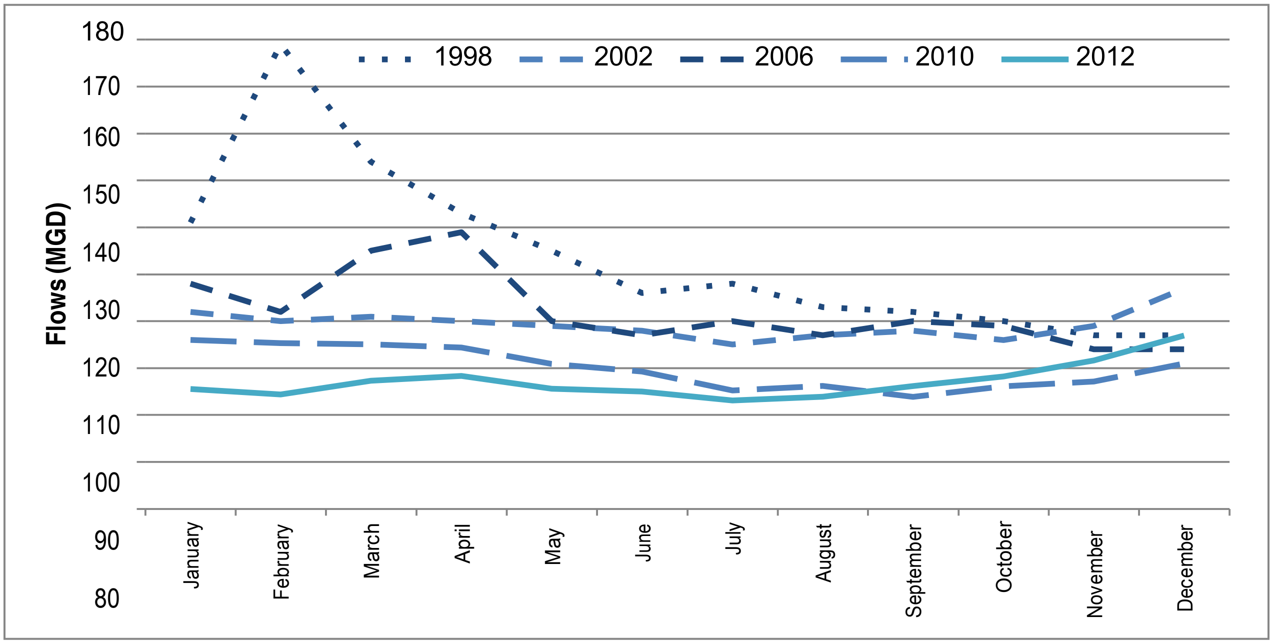
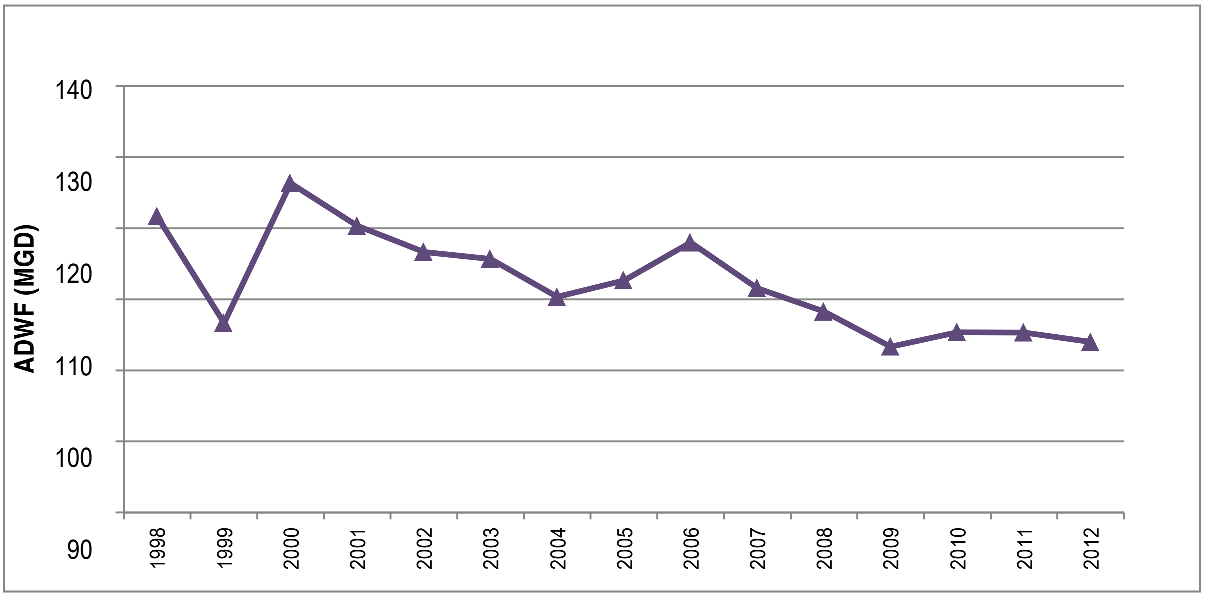


Figure 2: ADWF between 1998 and 2012



Notes:

1. *ADWF flows developed using plant flow data provided by James Ervin in an email dated April 22, 2013[Ref10].*

3.2 Average Dry Weather Flow Per Capita

Population estimates for the RWF service area are shown in Table 2 and are based on Santa Clara County population estimates by the US Census data[Ref5] and the percent of Santa Clara County population served by the RWF[Ref2]. Also shown in Table 2 is the per capita ADWF which is calculated by dividing the ADWF by the population served by the RWF. The per capita ADWF has steadily declined from around 100.6 gpcd in 2000 to 74.7 gpcd in 2012. Note that this per capita ADWF is higher than the 2012 residential per capita flow rate of 65 gpcd and 55 gpcd for single family and multi-family in San José[Ref6] because the per capita ADWF used in this TM includes industrial and commercial flow rates in

Note that the decrease in the ADWF was already observed in 2009 and noted in the RWF Master Plan TM. The decrease in the per capita ADWF may be attributed to multiple factors, including lower commercial occupancy rates, the adoption of additional conservation measures, changes in industry, elevated commercial vacancy rates, and implementation of programs targeted at reducing Inflow and

Table 2: Estimated Population in RWF Service Area

Year	Santa Clara County Population[1]	Santa Clara County Population Served by RWF	Estimated Population Served by RWF	Annual Population Percent Increase	ADWF (mgd)	Per Capita ADWF (gpcd)
2000	1,682,585	73.9%[2]	1,255,208	-	122	100.6
2005	1,698,234	74.2%[2]	1,260,090	0.1%	113	89.4
2010	1,781,642	75.6%[3]	1,346,921	1.4%	105	78.2
2012	1,837,504	75.8%[4]	1,392,093	1.7%	104	74.7

Notes:

1. *State of California, Department of Finance, E-4 Population Estimates for Cities, Counties, and the State, 2001-2010, with 2000 & 2010 Census Counts. Sacramento, California, November 2012.*
2. *Percent of Santa Clara County population served by RWF is from RWF Master Plan TM 3.6 Table 1.*
3. *Percent of Santa Clara County population is from RWF Master Plan TM 3.6 Table 3.*
4. *Percent of Santa Clara population is a linear extrapolation from percent of Santa Clara County population for years 2010 and 2015.*

4. RWF Influent Flow Projections Through 2035

4.1 Population Projection

In the 2009 RWF Master Plan, the Association of Bay Area Governments (ABAG) population projections were selected as the most suitable source for projecting populations within the accuracy range required for master planning purpose

For this analysis, two sets of population projections were used. The first set of population projections is based on the Center for the Continuing Study of The California Economy (CCSCE)'s "Summary of Results and Methodology"[Ref7] prepared for *The Envision San José 2040 General Plan*[Ref8]. Note that an exception was made for 2015 as no projection was available for 2015 in the CCSCE's report. As a result, the population projection for 2015 is based on 2009 ABAG Projections. The second set of population projections is based on the California Department of Finance's State and County population projections

Projected populations served by the RWF were estimated based on population projections for Santa Clara County as described above, and the percent of population in Santa Clara County estimated to be served by the RWF as estimated in the 2009 RWF Master Plan TM 3.6[Ref2]

Based on the CCSCE's population projections, the population is projected to increase between 1.0 percent and 1.6 percent annually between 2015 and 2035, and by 2.1 percent annually from 2012 through 2015. Overall, the population is projected to increase of 1.5 percent annually between 2012 and 2035. This is higher than the average population growth of 0.9 percent that has been experienced from 2000 to 2012. Note that the annual population increase of 2.1 percent from 2012 through 2015

The California Department of Finance's population projections are more conservative. As can be seen in Table 3, the population is projected to grow between 0.3 percent and 0.7 percent annually between 2015 and 2035, and by 0.8 percent annually between 2012 and 2015. Overall, the population is projected to increase by 0.5 percent annually between 2012 and 2035. This is significantly slower rate than the 1.5 percent annual increase rate projected by the CCCSE. Projected populations using the two

It should be noted that the population estimates assume that the ratio of jobs to the resident service area population will be constant over time, i.e. that there will be no resulting flow increase resulting from an increased percentage of commuter population over time.

Table 3: Projected Population in RWF Service Area

Year	Percent of Santa Clara County Population Served by RWF[3]	Santa Clara County Population Projection	Estimated Population Served by RWF	Annual Percent Increase (Percent)	Santa Clara County Population Projection	Estimated Population Served by RWF	Annual Percent Increase (Percent)
			CCSCE[2]			**California Department of Finance[4]**	
2015	76.0%	1,945,300[1]	1,478,428	2.1%[5]	1,874,604	1,424,699	0.8%[5]
2020	76.4%	2,090,000[2]	1,596,760	1.6%	1,889,898	1,443,882	0.3%
2025	76.6%	2,197,000[2]	1,682,902	1.1%	1,936,386	1,483,272	0.5%
2030	77.1%	2,306,000[2]	1,777,926	1.1%	1,986,545	1,531,626	0.7%
2035	77.5%	2,405,000[2]	1,863,875	1.0%	2,038,645	1,579,950	0.6%

Notes:
1. *2009 ABAG Projection, 2010 SCVWD UWMP.*
2. *Projections of Jobs, Population and Households for the City of San José. A summary of Results and Methodology. Prepared for the City of San José for The Envision San José 2040 General Plan Update.*
3. *RWF Master Plan TM 3.6 Table 3.*
4. *California Department of Finance's Report P-1, State and County Population Projections (5-year increment*
5. *Annual percent increase from 2012 to 2015.*

4.2 Projected Average Dry Weather Flow Per Capita

In order to estimate projected influent flows over time, two scenarios were assumed for future water conservation. The first scenario is based on the assumption that the per capita flow observed in 2012 will remain constant through the 2035 horizon; and so will the average dry weather flow per capita. Under this scenario, the average dry weather flow per capita of 74.7 gpcd for 2012, representative of current conservation measures, commercial occupancy rates and other I/I reduction programs being implemented by cities served by the RWF, is thought to be representative of future per capita

The second scenario assumes that the average dry weather flow per capita will continue to decrease over time. Under that scenario, the average dry weather flow per capita mirrors the reduction in the estimated water demand per capita within the RWF service area through 2035 (as a result of increased conservation) as estimated by the water retailers in the 2010 SCVWD Urban Water Management Plan (UWMP)[Ref4]. The estimated water demand per capita is calculated as the ratio of the total retailer demand projection and the estimated population served by the RWF (see Table 4). Then, the estimated average dry weather flow per capita is calculated by applying the percent reduction in the water demand to the average dry weather flow per capita for the previous five years and using 74.7 gpcd as the initial average dry weather flow for 2012. The average dry weather flow per capita estimated for

Table 4: Projected Per Capita ADWF Assuming Increased Conservation

	2015	2020	2025	2030	2035
Estimated Population Served by RWF[1,2]	1,478,428	1,596,760	1,682,902	1,777,926	1,863,875
Total Retailer Demand Projection in Area Served by RWF After Conservation (AFY)[3]	235,730	245,800	255,050	264,760	274,390
San José Water Company (AFY)	143,790	147,860	150,930	154,080	157,290
Greatoaks Water Company (AFY)	13,260	13,420	13,830	14,250	14,660
San José Municipal Water (AFY)	32,140	35,230	38,460	42,120	45,780
City of Milpitas (AFY)	15,280	16,240	17,220	18,240	19,230
City of Santa Clara (AFY)	31,260	33,050	34,610	36,070	37,430
Demand per capita in Area Served by RWF After Conservation (gpcd)	142	137	135	133	131
% Demand Reduction	-2.0%	-3.5%	-1.5%	-1.7%	-1.1%
Per Capita ADWF After Conservation (gpcd)	73.2	72.1	71.0	69.8	69.0

Notes:

1. 2009 ABAG Projection, 2010 SCVWD UWMP.

2. Projections of Jobs, Population and Households for the City of San José. A summary of Results and Methodology. Prepared for the City of San José for The Envision San José 2040 General Plan Update.

3. 2010 SCVWD UWMP Table 4-1 -Retailer Demand Projections after Conservation Savings.

4.3 ADWF Projection Estimates

A summary of the average dry weather flow per capita as well as the resulting total average dry weather flow under the two population projection scenarios and the two conservation scenarios is shown in Table 5. Actual average dry weather flow for 1998-2002 as well the range of projected

Note that the ADWF increases from 104 mgd in 2012 to 110 mgd in 2015 as illustrated in Table 5 when CCSCE's population projections are used. That increase is attributed to a population increase of approximately 2.1 percent annually during the same period (2012-2015)

When the California Department of Finance’s population projections are used, the ADWF is projected to remain level at 104 mgd between 2012 and 2015..

As can be seen in Table 5, the ADWF in 2035 is estimated to range between a minimum of 109 mgd (with additional conservation and Department of Finance’s population projections) and a maximum of 139 mgd (without additional conservation and CCSCE’s population projections).

This TM shows the full range of wastewater flow estimates since it is not possible to predict which of the various population estimates will prove to be more correct.

Table 5: Projected Per Capita ADWF Assuming Current and Increased Conservation

	Assuming Current Conservation			Assuming Increased Conservation			
	Per Capita ADWF Assuming Current Conservation (gpcd)	ADWF Assuming Current Conservation (mgd) (CCSCE)	ADWF Assuming Current Conservation (mgd) (California Department of	Per Capita ADWF Reduction Assuming Increased Conservation	Per Capita ADWF Assuming Increased Conservation (gpcd)	ADWF Assuming Increased Conservation (mgd) (CCSCE)	ADWF Assuming Current Conservation (mgd) (California
2015	74.7	110	106	-	74.7	110	104
2020	74.7	119	108	-3.5%	72.1	115	104
2025	74.7	126	111	-1.5%	71.0	119	105
2030	74.7	133	114	-1.7%	69.8	124	107
2035	74.7	139	118	-1.1%	69.0	129	109

As can be seen in Table 6, the projected ADWF in the 2009 RWF Master Plan was estimated to range between 141 mgd and 158 mgd by 2035. In comparison, the flow projections developed in this TM are significantly lower than the flow projections from the 2009 RWF Master Plan. For example, the projected maximum ADWF in this TM is 139 mgd by 2035 which is similar to the projected minimum ADWF in the 2009 RWF Master Pan (141 mgd).

The decrease in the projected ADWF can be attributed to several factors:

1) The population projections used in this TM are lower than those used in the 2009 RWF Master Plan.
2) The 2010 per capita ADWF of 74.7 gpcd (used as the basis for future average dry weather flow) is lower than the 2007 per capita ADWF of 86 gpcd used in the 2009 RWF Master plan. As mentioned earlier, the decrease in the per capita flow since the 2009 RWF Master Plan is

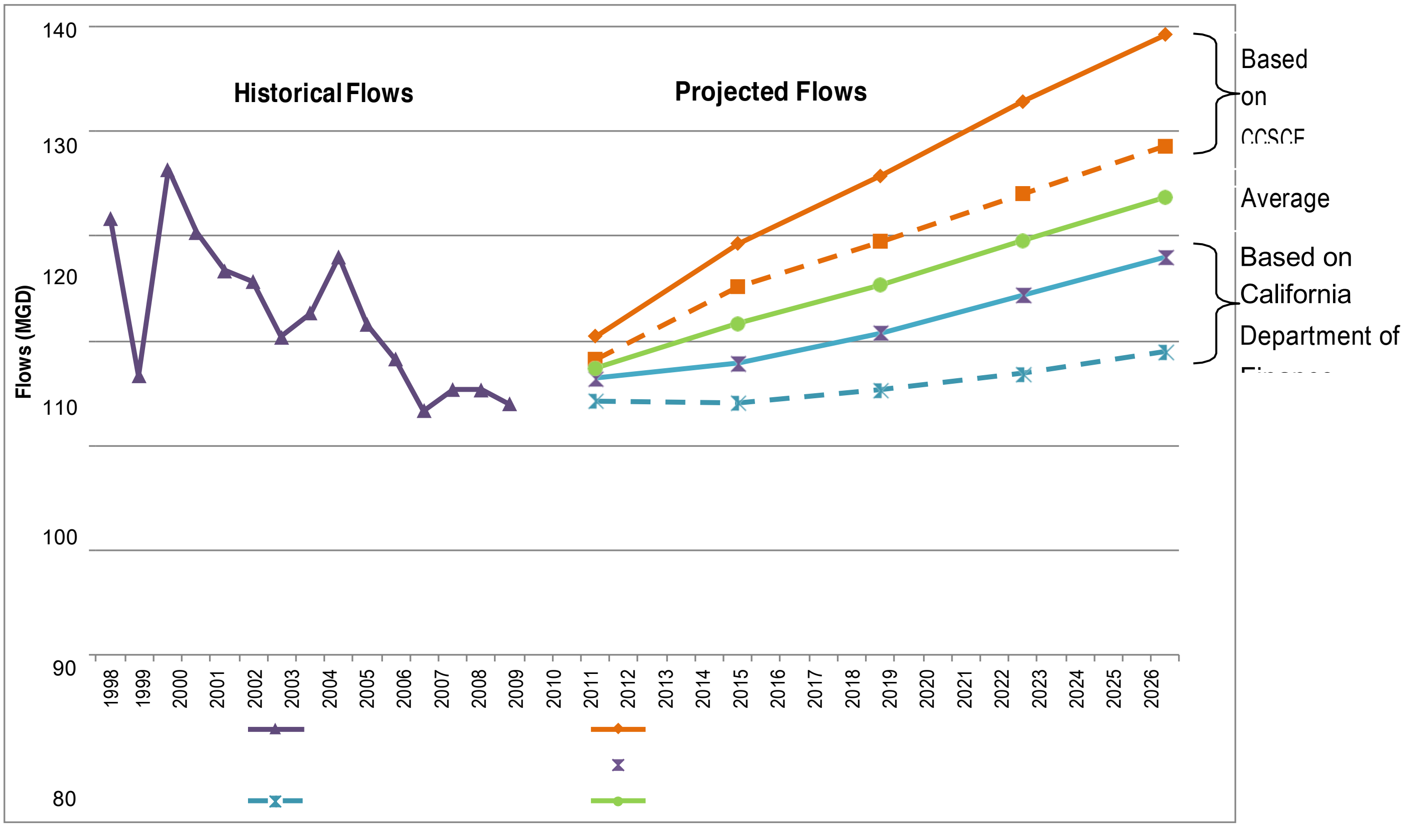
Table 6: Comparison of Projected Flows with Projected Flows from 2009 RWF Master Plan

	Projected ADWF in this TM			Projected ADWF From 2009 RWF Master Plan	
	Maximum ADWF (mgd)	Minimum ADWF (mgd)	Average (mgd)	Assuming 2007 Conservation (mgd)[1]	Assuming Increased Conservation (mgd)[1]
2015	110	104	108	128	123
2020	119	104	112	137	128
2025	126	105	115	143	132
2030	133	107	120	151	137
2035	139	109	124	158	141

Notes:

1. 2009 RWF Master Plan PM 3.8.

Figure 3: Historical and Projected ADWF Flows Through 2035



5. References

1. San José/Santa Clara Water Pollution Control Plant Master Plan Task No.3 Project Memorandum No.1 Historical Wastewater Flows. Final Draft. July 2009. Carollo, Brown and Caldwell, SOM.
2. San José/Santa Clara Water Pollution Control Plant Master Plan Task No.3 Project Memorandum No.6 Historical and Projected Service Area/Population. Final Draft. August 2008. Carollo, Brown and Caldwell, SOM.
3. San José/Santa Clara Water Pollution Control Plant Master Plan Task No.3 Project Memorandum No.8 Projected Wastewater Flows and Characteristics. Final Draft. July 2009. Carollo, Brown and Caldwell, SOM.
4. Santa Clara Valley Water District 2010 Urban Water Management Plan.
5. State of California, Department of Finance, E-4 Population Estimates for Cities, Counties, and the State, 2001-2010, with 2000 & 2010 Census Counts. Sacramento, California. November 2012.
6. City of San José Residential Unit Flow Rate Analysis, Estimated Residential Unit Flow rates & review of Strength Characteristics. RMC Water and Environment. February 28, 2013.
7.
8. [illegible]
9. Report P-1, State and County Population Projections (5-year increment), July 1, 2010-2060. California Department of Finance Demographic Research Unit. January 31, 2013.
10. Communications with James Ervin, City of San José. March 27, 2013 and April 23, 2013.

Appendix 3A - Milpitas Extensions

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Appendix 3A Milpitas Extensions

The City of Milpitas updated their recycled water plans in the fall of 2014 and developed a map of future recycled water extension shown in Figure 3A-1. The extension show potential alignments for deliver to the golf course plus service to irrigation on the east side of I680. The rounded, total long-term

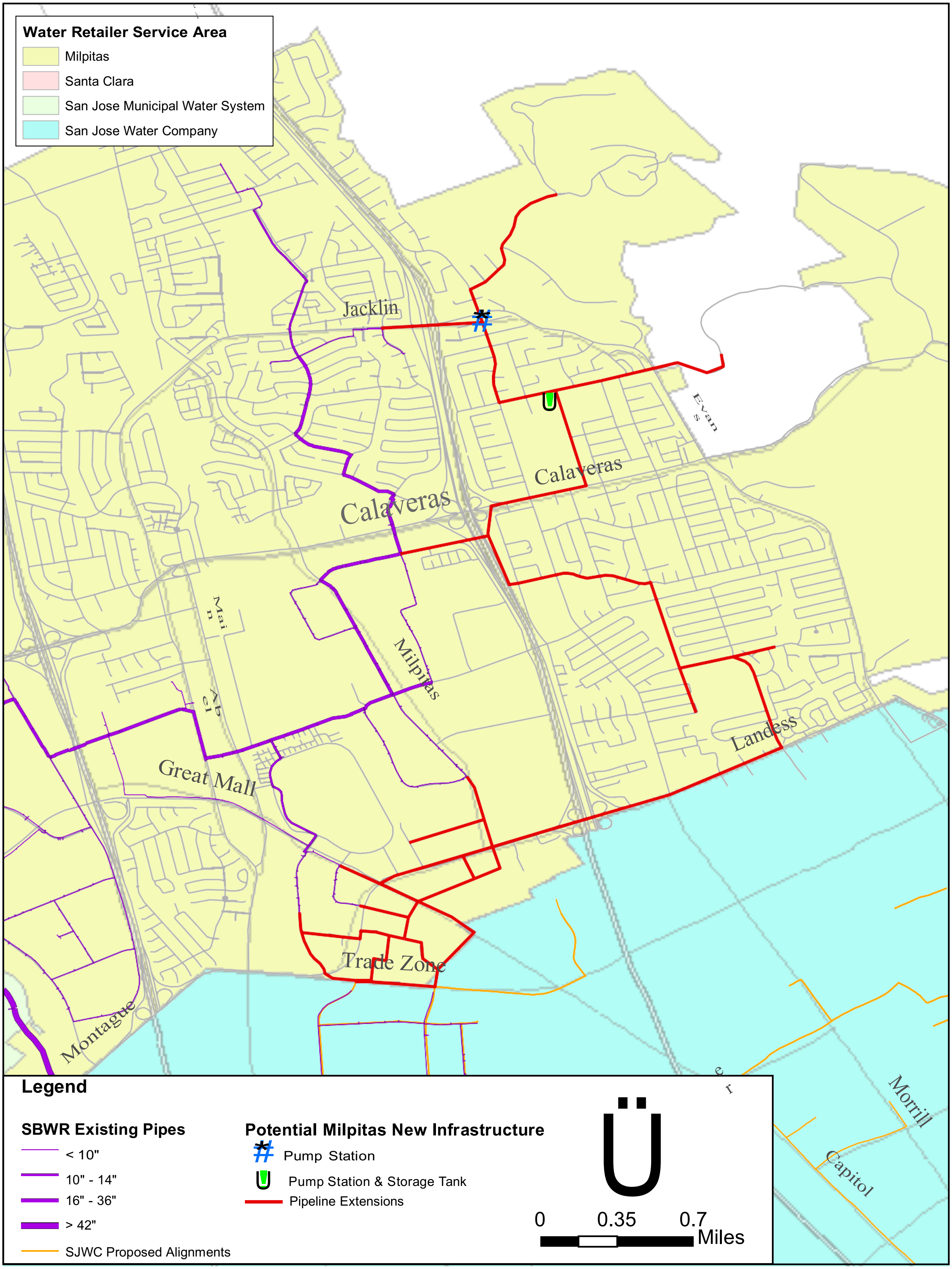

Figure 3A-1: Milpitas Extensions

Appendix 4A - Silicon Valley Advanced Water Purification Center

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Appendix 4A Silicon Valley Advanced Water Purification Center

The Silicon Valley Advanced Water Purification Center (SVAWPC) was constructed by the SCVWD in cooperation with the City to improve recycled water quality delivered through the SBWR distribution system. The primary water quality parameter targeted by the SVAWPC is total dissolved solids (TDS) concentrations. This will be accomplished through blending of the SVAWPC's RO permeate water with the tertiary process effluent from the RWF. The TDS target that has been discussed by the City and

The SVAWPC went on-line in early 2014. Its commissioning affected SBWR operations and reliability as described below.

- Provides new salinity control capabilities.
- Provides separate recycled water treatment train using secondary effluent as the feed water. The additional capacity (~8 MGD) allows for seasonal shutdown of the recycled water tertiary treatment process (based on current demands) and will supplement the total capacity to help meet peak summer time demands. **Error! Reference source not found.** shows the separate
- SVAWPC treatment train and the existing tertiary recycled water process.

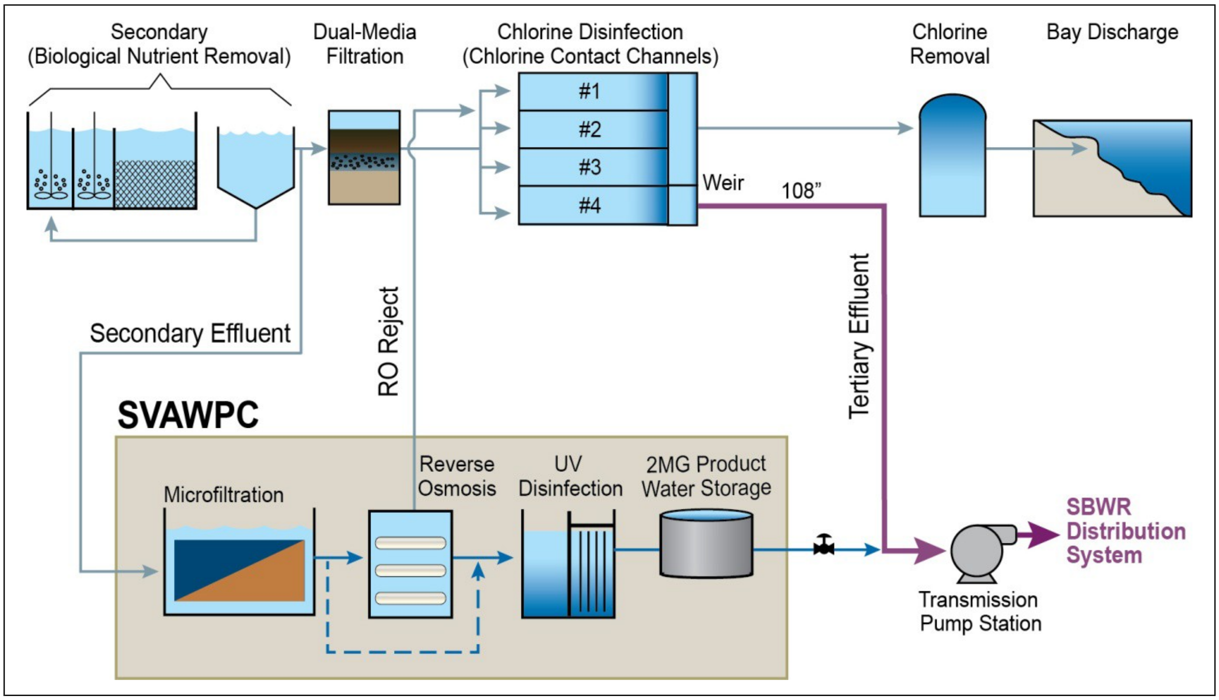
  SCVWD will operate the SVAWPC and the City will continue to operate the tertiary recycled

The SVAWPC produces low salinity water that will be used to reduce salinity of the recycled water supply. Under normal operation, recycled water operators will be able to provide a more uniform salinity. However, water quality reliability is a potential challenge as the SVAWPC has single points of failure risks, capacity limitations, and salinity control is reliant on coordinated operations with tertiary

Treatment Process

The SVAWPC has an RO capacity of 8 MGD with no standby units. Providing consistent salinity while realizing the full 8 mgd capacity of the SVAWPC will be an operational challenge as operators need to carefully coordinated TPS flow so the SVAWPC storage reservoir is full at the start of the peak TPS flow

Figure 1: SVAWPC Recycled Water Treatment Train



Assuming the RWF produces recycled water with an average TDS of 720 mg/l and SVAWPC product water has a TDS of 50 mg/l, the combined facilities could produce 24.4 MGD of 500 mg/l water (assuming ideal blending/mixing). Based on the latest 2013 TPS flow data, a maximum day flow of 25.3 MGD has been observed, thus exceeding the capacity of the SVAWPC at a TDS goal of 500 mg/l. With future increases in recycled water demand, additional capacity at the SVAWPC would be needed to continue to meet the target salinity. The SVAWPC was designed to accommodate an additional 1 mgd of RO vessels within the existing footprint. Given the same TDS assumptions for the RWF and SVAWPC product water, with an RO capacity of 9 MGD, SBWR could provide 27.4 MGD of 500 mg/l water. This

Table 1 illustrates how operations could adjust the salinity goal to achieve higher blended water flow capacity with either the existing 8 mgd or expanded 9 mgd of RO capacity. A salinity goal of 600 mg/l could be implemented on a seasonal basis to ensure uniform water quality is provided.

Table 1 Combined Capacity at Various Salinity Goals

Capacity for Various Salinity Goals (mg/l)	Tertiary RW TDS (mg/l)	Tertiary Production (MGD)	SVAWPC TDS (mg/l)	SVAWPC RO Production (MGD)	Theoretical Combined Production Capacity at TS Goal[a] (MGD)
500	720	16.4	50	8	24.4
550	720	23.5	50	8	31.5
600	720	36.7	50	8	44.7
604	720	38.1[b]	50	8	46.1
500	720	18.4	50	9	27.4
550	720	26.5	50	9	35.5
592	720	38.1[b]	50	9	47.1

Notes:

a. *Theoretical production capacity is the flow that can be produced assuming no upstream or downstream limitations. In reality, influent flow, future demand patterns and existing downstream facilities may limit the ability to realize these theoretical flows.*

b. *Current capacity of the existing recycled water production facilities (tertiary filter capacity).*

The SVAWPC may be subject to both planned an unplanned maintenance shutdowns. Planned outages include periodic inspection of the inter-process tank and product water storage tank. Planned outages can be scheduled during winter months when demands are lower.

The SVAWPC also has numerous single points of failure (i.e. modulating control valve, flow meter, permeate pipeline, secondary effluent pipe, influent pumps, RO feed pumps, wastewater return line, brine line and electrical feed) that are a future concern as the facility ages.

Proposed Reliability Improvements

As part of the Reliability Workshop described in Section 4, potential improvements were also proposed for the SVAWPC. The proposed projects are summarized in Table 2. However, none of the projects

Table 2: Summary of Near-Term Reliability Project Prioritization

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
SVAWPC Projects					
AWP1	Water Quality Control Instruments	Provide spare water quality control instruments to minimize shutdown periods in event of	• Provides instrumentation for more reliable uniform water quality production	$100 - $200k	4
AWP2	Redundant Modulating Valve, Flow Meter, and TPS Feed Pipe	Add redundant permeate modulating valve to eliminate single point of failure for salinity blending	• Addresses potential single point of failure of the key components that deliver permeate to the TPS and that control the ratio of permeate to	$1 -$1.5 million	3
AWP3	Increase Production Capacity	Add 2 mgd of RO capacity to meet blended salinity goal of 500 mg/l during summer time demand periods	• Enables SBWR to meet the blended water TDS target of 500 mg/l at anticipated summer time baseline flows	$24 - $27 million	4
AWP4	Revise Salinity Blending Control Strategy	Modify salinity blending control algorithm to modulate blend based on tertiary effluent TDS in	• Provides more uniform blended water TDS by adjusting permeate blend based on TDS in	<$50k	3
AWP5	Equipment Redundancy	Add redundant influent feed pump, RO feed pump, and electrical feed to eliminate single	• Addresses potential single point of failure. • Provides redundancy for equipment	$100 - $200k	4

Appendix 4B - Near Term NPR Fact Sheets

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Appendix 4B

Near-Term NPR Reliability Project Fact Sheets

Introduction

This appendix includes more information about the projects described in Section 4 of the report. This includes an assessment of costs and benefits for the recommended 5 year CIP projects as well as the fact sheets for all of the projects (both recommended and additional) discussed in Section 4

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Summary Table

Table 4b-1: Recommended Near-Term Reliability Improvements

Project Number	Project Name	Challenge Addressed	Costs	Technical Benefit	Operations/Maintenance Staff Benefit	Reliability Benefit
Increase Production Capacity to 53 mgd						
P6	TPS Capacity Upgrade	Provide additional TPS pumps/capacity to ensure that there is unit redundancy (i.e. standby pumps) in the event of a pump failure.	**Design/Construction Costs:** $1 - $3 million	Increases TPS capacity to meet long-term peak demands		Increases TPS capacity to ensure that there is unit redundancy (i.e. standby pumps) in the event of a
P8a	Increase Filter Flux Rate – Filtration Flux Studies/Implementation (~57 MGD for 4 filters; >114 MGD for 8 filters)	Peak hour demands approaching system filtration capacity makes operations challenging. The filtration limitation requires the Operation staff to install stop gates to divert an additional 4 filters for RW production.	**Engineering Report and SOP Costs:** $75,000 **Design/Construction Costs:** $0	Increase capacity in existing RW filter bank from 39.7 mgd to ~57 mgd (4 filters).	Eliminates need to modify filter facilities to allow 8 filters to be used for RW. Assume 20 hours per year to modify facilities and operations. Assuming	Reduces risk of running out of water unexpectedly during a Zone 1 Demand spike.
P8b	Reduce CT Requirement (Free Chlorine Disinfection Study; Ammonia and Hypochlorite Improvements) (~200 MGD capacity assuming 20 min CT; Generally, do not need to worry about CT.)	Operations staff effort ("every day") is required to manage the recycled water disinfection/chlorination (contact time requirement of 90 minutes) during summer months to ensure enough water is produced/available. The disinfection limitation requires "daily" juggling of the RW pump stations (i.e. TPS, PS5, PS8, PS11) and storage tanks. Potential risk of regulatory violation or	**Planning Costs:** $300,000 **Design/Construction Costs:** ~$200,000 to $500,000 (Cost dependent on required project scope)	Disinfection capacity (Chlorine contact time) would no longer be a limiting factor. Chemical savings maybe achieved depending on required chlorine residual. Assume 10% savings in chemical or about $30,000 per year.	Reduced control room operator effort (estimated savings of 0.5 hours/day). Assuming $175/hr labor + benefits, savings of ~$31,900 per year.	Regulatory Benefit: Reduces risk of RW regulatory (Title 22) violation. Reduces risk of running out of water unexpectedly. Unexpected RW shutdowns are a customer retention and
Improve Distribution System Stability						
D5	Upgrade Pump Station 5 Bypass – construct a new 42-inch diameter bypass	Recycled water cannot flow back from storage reservoirs to Zone 1.	**Design/Construction Costs:** $300 - $500k	Will allow PS 5 to be taken out of service for maintenance while still keeping the backbone pipeline in		

Project Number	Project Name	Challenge Addressed	Costs	Technical Benefit	Operations/Maintenance Staff Benefit	Reliability Benefit
D9a	Add Zone 1 Storage equivalent to 25 - 50% of maximum day demands.	No Zone 1 storage means entire peak demands need to be provided by TPS which consumes high rates of energy. Pump must also operate on demand rather than at best efficiency points.	**Design/Construction Costs:** $40 - $50 million	Improves current mismatch between storage and location of demands. Zone 1 has the highest demands but has no storage reservoir. Improves ability to meet LOS goals, particularly for Zone 1 customers Reduces the peaking factors at TPS thereby reducing the swings in production rates and making it easier to maintain a uniform blend		Improves reliability of existing distribution system, which is difficult to operate, manually intensive, and potentially prone to outages due to lack of storage and automated controls. With increased demands expected by 2015, hydraulic modeling suggests that the current system configuration may become unstable during high demand periods and prone to unplanned customer and/or
Restore/Rehabilitate Existing Condition-Related Deficiencies						
D1a-1	Replace Pump Station 5 VFD's	These VFD's are obsolete and have exceeded their expected service life	**Design/Construction Costs:** $60,000	Replacement of the VFD's is needed to reduce the potential for emergency shutdowns due to VFD		
D1a-2	Other Condition Assessment Projects (2010-2015 Projects) for other near-term needs identified in the July 2010 SBWR System Condition Assessment. Future needs should be identified in conjunction with the RWF Asset management program]	Establish a budget to begin addressing the other near-term rehabilitation projects identified in the July 2010 SBWR System condition Assessment report. Lack of up keep may result in system outages or unsafe work conditions.	$2 million/year allocation for miscellaneous repair [Note this is a starting budget allocation for Asset management. This budget should be refined as greater understanding of asset	Maintain asset value and performance of existing system. Provide safe working environment.		Minimizes emergency system outages. Reduced system downtime when emergency or planned outages occur.
D2	Valve Exercising Program - Develop and implement a comprehensive valve exercising program that would target	Lack of up keep will result in premature valve failure and will limit ability to effective address pipeline condition/emergency issues.	<$100,000/year	Maintains valve so they work when needed.		

Project Number	Project Name	Challenge Addressed	Costs	Technical Benefit	Operations/Maintenance Staff Benefit	Reliability Benefit
	backbone pipeline system, including line isolation valves and air valves (including associated small isolation valves). The program would implement routine valve exercising of					
D11	PS 5 and PS 8/11 Electrical Room HVAC system upgrades	PS5 and PS 8/11 VFDs shutdown due to high heat. HVAC system at PS5 and PS 8/11 are not adequate resulting in the VFD. Requires electrician to drive out to PS to reset VFD's.	**Design/Construction Costs:** ~$150,000 to $250,000 (Budgetary estimate - formal scoping effort needed to refine	Increased HVAC cooling extends life of electrical equipment and prevent emergency shutdowns. Assumes VFD life expectancy reduced by 50%. Assume extra	Eliminates emergency response calls to PS5 and PS 8/11. One call per week during summer months. 18 hours per year. Assuming $175/hr labor + benefits,	Reduce PS5 and PS 8/11 shutdown which can limit water availability in Zone 2 and 3.
Update Control Strategies/Equipment to Improve Operational Efficiency						
P9a	SCADA and Controls Upgrade – Filter Backwash Automation	Obsolete manual control system for recycled water filter process. Operator spends 40 minutes per each backwash event. Filter process not optimized for run time or backwash process.	**Planning Costs:** $100,000 **Design/Construction Costs:** ~$200,000 to $500,000 (Cost dependent on required project scope) Note that PG&E incentives may be available for	Automated backwash process initiated and controlled by PLC. Provide operator control station/HMI. Longer media life due to reduced backwashing. Over time less energy as longer run times reduce energy consumed during backwash.	Reduced operator labor for filter building by 6 hours per day or 2190 hours per year for entire filter process. Assuming $175/hr labor + benefits, savings of ~$383,000 per year.	
P9b	SCADA and Controls Upgrade • Automated operation of pump stations to turn on and off on a schedule. • Automated controls to fill reservoir during low system	Obsolete manual control system for recycled water distribution system. Currently, operators need to turn pumps on and off and manually manage reservoir water levels.	**Planning Costs:** $150,000 **Design/Construction Costs:** ~$0.5 to $2 million (Cost dependent on required project scope) Note	Daily operation of pump stations and storage reservoir will be programmed into computer. Pump station 11 pumping could be optimized to take advantage of lower cost energy periods.	Operations staff can focus on system optimization leading to process savings, greater energy efficiency rather than manual operation of system.	Programmed operation has less susceptibility to human error that could lead to shortfall in daily water supply.

Project Number	Project Name	Challenge Addressed	Costs	Technical Benefit	Operations/Maintenance Staff Benefit	Reliability Benefit
	pumps when reservoirs are full.		may be available for this project.	efficiency point.	hrs/year. At $175/hr labor + benefits, savings of $95,800	
D6	Automate Zone Bypass Valve at Pump Station 8/11	Allows zone bypass at Pump Station 8/11 to be activated remotely, Eliminating need for operators to manually open two isolation valves	**Design/Construction Costs:** <$50k	Automated operation valves at PS 8/11 to allow water from Zone 3 back to Zone 2.	Eliminates the need for an operator to drive out to PS 8/11 when the operation is	
Provide Operator Operation Support						
S5	Update SBWR Systems Operations Manual – Any update to the O&M manual should be completed as the SBWR system evolves or any time a major capital project is implemented	Existing O&M manual is obsolete.	$100 to $200k	Provide direction on how to best operate and maintain the RW system. Provides health and safety protocols for systems. Enhanced maintenance of assets	Provides up to date resource for operations and maintenance personnel. Enhances health and safety protocols for employees	Reduces potential for shortfall of water due to operator error.

Fact Sheets – Recommended CIP Projects

Project Name: P6-Transmission Pump Station (TPS) Capacity Upgrade

Estimated Cost: $1M-$3M

Project Priority: 3

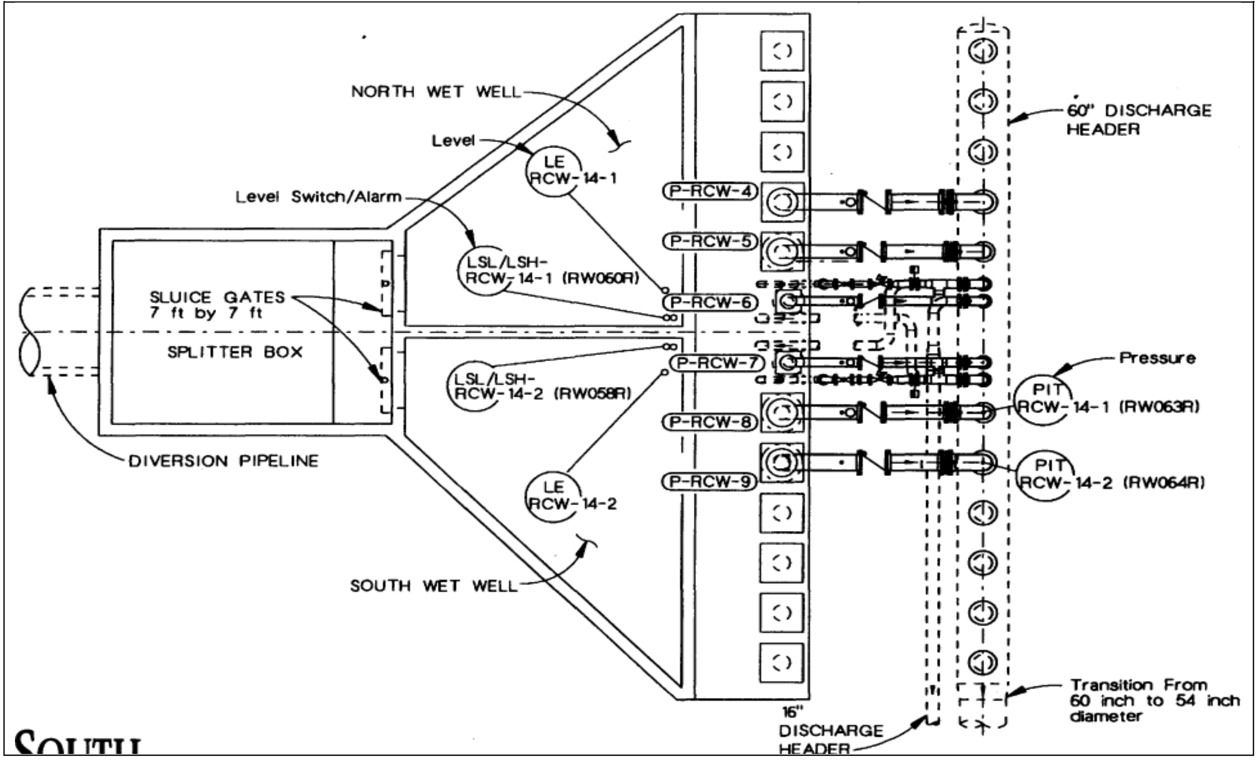
Project Category: New Infrastructure

Detailed Project Description

TPS capacity may need to be increased to meet future demands. The existing TPS firm capacity is approximately 45.5 MGD with one of the largest pumps (14.7 MGD) out of service. However, TPS should not be allowed to pump more than 44 MGD as this is the max flow allowed to ensure modal chlorine contact time of 90 minutes in CCC#4 and the 108” pipeline. The average capacity of the TPS facility is a function of downstream infrastructure and upstream production limitation. As demands and production capacity increase in the future, additional pumps will need to be installed in to meet

TPS has seven additional pump bays (see Figure 4b-22) to allow for installation of new pumps for increased capacity. This project would add pump(s) and associated improvements to increase the capacity of TPS, as needed. In addition, this project would also review associated components at TPS to ensure adequate capacity is available, including evaluation of the splitter box and the discharge header pipeline. The future required TPS capacity will depend on the location and volume

Figure 4b-1: TPS Schematic



Source: SBWR Operations and Maintenance Manual.

Project Trigger for Implementation

This project addresses future recycled water demands. Therefore, this project should be considered for design and implementation as recycled water demands continue to increase

Benefits Provided by Project

This project provides additional TPS pumps/capacity needed to meet increasing demands and to ensure that there is unit redundancy (i.e. standby pumps) in the event of a pump failure.

Project Name: P8 – Filtration and Chlorination Studies

This fact sheet includes information for both Project P8a and P8b.

Estimated Cost: $1,000,000

Project Priority: 1

Project Category: System Operations

Detailed Project Description

The maximum allowable filter loading rate is currently set at 5 gpm/sf and the minimum chlorine contact time is 90 minutes as required by the California Title 22 recycled water standards. This project would increase the recycled water production capacity by implementing studies to allow the filtration rate to be increased to 7.5 gpm/sf and the chlorine contact time to be reduced to as little as 20 minutes. There is precedence for both of these operational changes to be approved by the

- Filtration Studies: Several recycled water plants, including the Monterey WPCP and the Delta Diablo Sanitation District have undertaken Filter Loading Evaluation for Water Reuse (FLEWR) to prove the efficacy of their tertiary filtration processes at a higher loading rate. The RWF began the FLEWR studies but did not complete them. This project would complete the required filtration studies and work with CDPH to have the allowable loading on the tertiary filters re-rated to 7.5 gpm/sf. This means that all of the filter cells could be operated at the same loading rate, all the tertiary filtered flow would be Title 22 compliant from a filtration standpoint, and the filtration process would no longer be a factor in limiting recycled water production.
- Chlorination Studies: Sanitation Districts of Los Angeles County (Districts) developed a two-step "sequential chlorination" process. In the first step, free chlorine is added to fully nitrified secondary effluent to inactivate pathogens and to react with NDMA precursors, thus reducing subsequent NDMA formation. Chloramines are then added to media filtered effluent to stop formation of trihalomethanes (THMs) and haloacetic acids and to provide further disinfection. The use of free chlorine in the first step of the disinfection process is more effective than chloramination and CDPH has given the Districts permission to reduce their required modal contact time from 90 minutes to <10 minutes.

Project Trigger for Implementation

This project increases the production capacity to meet the anticipated peak hour demands for both baseline and baseline plus committed flow and should be implemented immediately.

Benefits Provided by Project

- This is the lowest cost alternative to increase recycled water production capacity.
- Increases rated production capacity to meet peak baseline plus committed demands.
- Allows all filters, and potentially all CCC's to be operated for recycled water production,

- Potentially reduces NDMA formation by using free chlorine for disinfection followed by chloramination.

Project Name: D5- Upgrade Pump Station 5 Bypass

Estimated Cost: Less than $500,000

Project Priority: 1

Project Category: Improvements to Existing SBWR Infrastructure

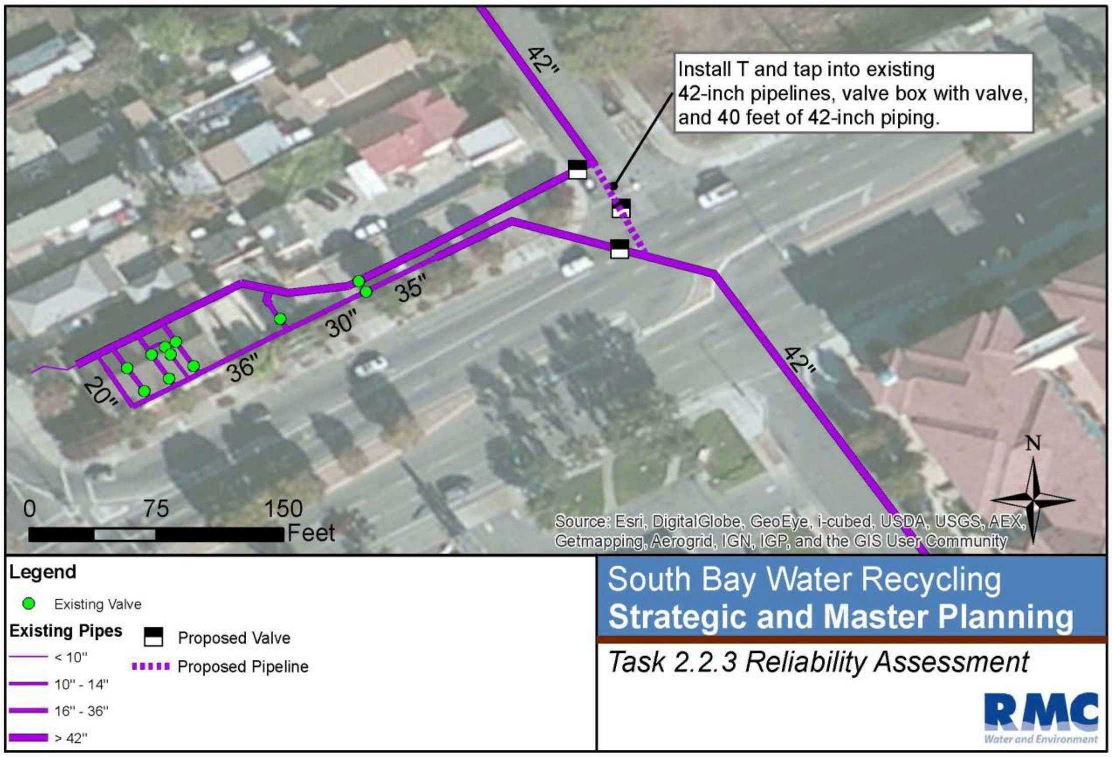
Detailed Project Description

Currently, the Pump Station 5 bypass is inadequate for pumping from TPS directly to Yerba Buena Reservoir and Pump Station 8 while allowing Pump Station 5 to be taken off line for maintenance. Redundant isolation valves are needed to isolate the station while using the bypass, which means that the backbone pipeline serving Pump Station 5 must be isolated upstream and downstream of Pump Station 5 to achieve double isolation. This results in system downtime during maintenance

This project consists of construction of a new 42-inch diameter bypass pipe at 12th Street and Keys Street bridging between the upstream and downstream 42-inch backbone pipeline to and from Pump Station 5. Isolation butterfly valves would be installed to serve as the redundant upstream and downstream isolation for taking Pump Station 5 out of service for maintenance, allowing the backbone pipeline to remain in service. An isolation butterfly valve would also be installed in the

This project would also support a reconfiguration of the SBWR distribution system into a traditional pressure zone configuration with TPS pumping to Yerba Buena Reservoir (Zone 1). This is further described in Project D9

Figure 4b-2: Proposed Pump Station 5 Bypass


42"
Install T and tap into existing 42-inch pipelines, valve box with valve, and 40 feet of 42-inch piping.
35"
30"
36"
20"
42"
N
0
75
150
Feet
Legend
Existing Valve
Existing Pipes
< 10"
10" - 14"
16" - 36"
> 42"
Proposed Valve
Proposed Pipeline
South Bay Water Recycling
Strategic and Master Planning
Task 2.2.3 Reliability Assessment
RMC
Water and Environment

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Project Trigger for Implementation

This project would be a required part of new storage project, and addresses current operational issues. Therefore, this project is needed at baseline and future demands to maintain customer LOS.

Benefits Provided by Project

This project would address vulnerabilities associated with having to take the backbone pipeline out of service to perform maintenance tasks at Pump Station 5.

Other

This project is a required component of the conversion of Yerba Buena Reservoir into a Zone 1 Reservoir (see Project D9).

Project Name: D9 – Additional Zone Storage and Zone Reconfiguration

Estimated Cost: Project D9a: $40-50 million
Project D9b: $36 – 39 million

Project Priority: Project D9a: Priority 1
Project D9b: Priority 3

Project Category: New Infrastructure

Detailed Project Description

Recycled water systems typically have storage sufficient to provide from 50 percent to 100 percent of the maximum day demand to manage peak hour demands and provide some emergency supply in case of a disruption in recycled water production or distribution facilities. Table 4b-1 is a

As shown in Table 4b-1 for current demands, SBWR has barely adequate total volume of storage in the system, but it is not located in the appropriate zone. Also, under baseline demands, total system storage would be inadequate

Table 4b-1: Summary of SBWR System Storage

Zone	Existing Storage (MG)	Current Maximum Day Demand[c] (MGD)	Storage: Max. Day Demand (%)
1	--	13.0 MGD	0%
2[a]	4 MG	1.8 MGD	222%
3[b]	5.5 MG	5.2MGD	106%
Total	9.5 MG	20.0 MGD	48%

a. *Yerba Buena Reservoir could serve Zone 1 through a 12-inch zone valve at Pump Station 5 and currently serves Zone 2, but only with boosting through Pump Station 8. Neither option is sufficiently reliable.*
b. *Zone 3 demand includes The Villages hydropneumatic zone, which is supplied from Zone 3.*
c. *Maximum day demands taken from Draft Technical Memorandum – South Bay Water Recycling Pump Control Strategy Evaluations, ID Modeling, July 2013, Table 4.*

This project would identify sites and implement zone storage projects to meet the 2015 baseline plus commitments demand conditions (assumed to be 37.5 MGD maximum day demand) and better allocate system storage to appropriate pressure zones. The minimum zone storage allocation criterion is assumed to be 50% of the maximum day demand for that zone, excluding flow through the zone to a higher zone. Roughly an additional nine million gallons of new storage would be needed to meet demands across the distribution system zones for the 2015 baseline plus

Table 4b-2: Proposed SBWR System Storage for 2015 Baseline Demands Plus Commitments

Zone	Existing Storage (MG)	Proposed Additional Storage (MG)	Total Proposed Storage (MG)	Baseline Maximum Day Demand (MGD)	Storage: Max. Day Demand (%)
1	--[a]	7.75[a]	11.75[a]	23.5	50%
2	4[a]	1.55	1.55	3.1	50%
3	5.5	0	5.5	10.1	54%
Villages[b]	0	0	0	0.7	0%
Total	9.5	9.3	18.8	37.5	50%

a. The Villages does not currently have storage and storage is not proposed for this individual customer.

Table 4b-3: Proposed SBWR System Storage for Baseline Demands in 2015

Zone	Existing Storage (MG)	Proposed Additional Storage (MG)	Total Proposed Storage (MG)	Baseline Maximum Day Demand (MGD)	Storage: Max. Day Demand (%)
1	--[a]	6.75[a]	10.75[a]	21.5	50%
2	4[a]	1.5	1.5	3.0	50%
3	5.5	0	5.5	5.1	108%
Villages[b]	0	0	0	0.7	0%
Total	9.5	8.25	17.75	30.4	60%

a. The Villages does not currently have storage and storage is not proposed for this individual customer.

The first phase of this project (D9a) would add approximately 6 million gallons of storage to Zone 1 since it is the zone with the highest demand/lowest storage in the system. The planning work for D9a has begun with a Reservoir Siting Study which is being performed under a separate effort

The second phase of this project (D9b) would add additional storage in Zone 1 to meet near and long-term demands. This is a lower priority project and is not included in the recommended near-term reliability improvements

Project Name: D1a - SBWR Renewal/Replacement Projects 2014-2015

This fact sheet includes information for both Projects D1a-1 and D1a-2.

Estimated Cost: $18M-$21M

Project Priority: 2

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

The 2010 SBWR Condition Assessment report outlines a number of projects needed to maintain and extend the expected service life of SBWR distribution facilities. While some of the recommendations of the SBWR Condition Assessment have been implemented, other recommendations have not, increasing risk of component or facility failure that would impact customer LOS. Project D1 includes two phases: D1a-SBWR Renewal/Replacement Projects 2014-2015 and D1b-SBWR Renewal/Replacement Projects 2016-2020 – that would include planning and

Project D1a focuses on projects that the SBWR Condition Assessment recommended for implementation during the five-year period from 2011-2015, with the exception of the recommended SBWR Controls System Upgrade. The SBWR Control System Upgrade is not included here because through the SBWR Strategic Plan it was identified as a high priority, standalone project

Table 4b-8 summarizes the individual components of this project and the associated cost of each:

Table 4b-4: Summary of Renewal/Replacement Recommendations from SBWR Condition Assessment

Facility	Range of Renewal/Replacement Projects	Cost
Pump Station 5	• Replace booster pump VFDs • Replace booster pump pressure switches • Replace submersible sump pump • Replace corroded building plumbing piping • Reseal and remark pavement and repair parking lot pavement • Repair building siding and repaint	• $2,140,000
Pump Station 8	• Replace pump expansion joints • Replace various electrical panels: surge tank control panel, HTP tank control panel, telephone/security panel • Replace pump VFDs • Improve drainage for vaults • Replace HID lighting with LED lighting	• $1,280,000

Facility	Range of Renewal/Replacement Projects	Cost
Villages Pump Station	• Replace/rehabilitate pumps • Replace/rehabilitate piping and pipe supports • Replace flowtronic pumping control cabinet • Replace pressure transmitter • Replace/rehabilitate butterfly isolation valves • Enclose facility	• $3,560,000
Yerba Buena Reservoir	• Rehabilitate site paving	• $20,000
Pipeline Valves	• Replacement of 208 isolation valves and 246 control valves	• $11,940,000

Note: Costs are based on capital costs in the 2010 SBWR Condition Assessment escalated to current ENR.

Project Trigger for Implementation

This project is needed at baseline and future demands to maintain customer LOS.

Benefits Provided by Project

The project addresses multiple existing vulnerabilities within the SBWR distribution system related to component conditions and deficiencies (as observed in 2010) that could result in failure or reduced operational effectiveness.

Project Name: D2 - Valve Exercising Program

Estimated Cost: Less than $100,000

Project Priority: 2

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

Existing system line isolation valves and air valves have not been regularly exercised to demonstrate serviceability. As SBWR operators have had to perform maintenance on various reaches of the system pipelines, they have discovered that many existing valves are frozen and cannot be closed or

This project would consist of developing and implementing a comprehensive valve exercising program that would target the most critical valves on the backbone pipeline system, including line isolation valves and air valves (including associated small isolation valves). The program would implement routine valve exercising of all system valves every one to two years. Valves found to be

The valve exercising program could be integrated with the system asset management program (Project S2).

Project Trigger for Implementation

This project is needed at baseline and future demands to maintain customer LOS.

Benefits Provided by Project

The project addresses the uncertainty of valve operability in the system and the deferred progress in maintaining valve serviceability. It also reduces the duration of planned or emergency outages by keeping existing distribution system isolation valves in acceptable working order.

Project Name: D11 – PS5 and PS8/11 Electrical Room HVAC replacement

Project Name: P9 - SCADA and Controls Upgrade

This fact sheet includes information for both projects P9a and P9b.

Estimated Cost: $7M-$9M

Project Priority: 2

Project Category: SBWR System Operations

Detailed Project Description

The existing leased telephone line communication system is currently being upgraded to a wireless cell-based system for all remote facilities. The existing Transdyn System for the SBWR system is out of date and was recommended for replacement in the SBWR Condition Assessment

The existing ABB/Bailey Distributed Controls System (DCS) at the RWF and the Allen Bradley PLCs at the remote sites may need to be upgraded to provide needed functionality for operational flexibility. The SBWR Condition Assessment noted that changes to control strategies and PLC programs are not well documented, follow-up updates are cumbersome, and present control algorithms do not appear to function reliably. No changes to the PLC programs or documentation

Upgrade the current control system to meet current and projected future operational needs of the SBWR production and distribution systems. Investigate open-system architecture for the control software that allows for future expansion of the system and associated data points. Upgrades and replacement of remote site equipment, software and programming required for integration with the ABB/Bailey DCS at the RWF and the Allen Bradley PLCs at the remote sites (or upgrades of those

The SCADA and controls upgrades should be developed considering potential system and facility reconfiguration that accommodate zone storage and pipeline looping (e.g. Projects D8 and D9). Remote operating functionality within the control system is necessary for efficient and flexible

Project Trigger for Implementation

This project addresses current deficiencies with the SBWR control system. Therefore, the project is needed under baseline and future system demands to maintain customer LOS

Benefits Provided by Project

- Address current deficiencies within the SBWR control system including limited functionality, and difficulty in servicing and obtaining spare parts for obsolete equipment
- Updates control strategies and algorithms to improve operational efficiency.
- Provides equipment and programming for integration of RWF DCS with the remote site PLCs
- Reduces burden on operators currently operating system manually by implementing control algorithms that allow the system to self-regulate during normal operations.
- Provides enhanced trouble detection ability that can allow operator intervention ahead of an unplanned outage.

Project Name: D6- Automate Zone Bypass Valve at Pump Station 8/11

Estimated Cost: Less than $500,000

Project Priority: 2

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

The existing zone bypass pressure reducing valve at Pump Station 8/11 cannot be activated or controlled remotely and requires operators to manually open two isolation valves to initiate zone valve operations. The zone bypass functions to convey Zone 3 water into lower zones.

The project would allow the existing 12-inch diameter pilot-operated pressure reducing valve to be open/close with a signal through the SBWR SCADA system. The control instrumentation complete with wiring has been installed on the pilot system, but the remote controls have not been provided to the operator. Control software would need to be added to the local PLC to allow a feedback loop based on the existing bypass flow meter reading and an operator flow set point value. Additional electrical and controls work would be needed for a fully remote operated bypass. The project

This project would be implemented in a coordinated manner with the operations manual update (Project S5) and the SCADA system upgrade (Project S4).

Project Trigger for Implementation

This project addresses current system operational and supply reliability. Therefore, the project is needed under baseline and future system demands to maintain customer LOS.

Benefits Provided by Project

This project would address vulnerabilities associated with disruptions in lower zone supply by allowing remote operation of the zone valve to deliver recycled water into Zones 1 and 2 from Zone 3 storage.

Project Name: S5 - Update SBWR Systems Operations Manual

Estimated Cost: Less than $500,000

Project Priority: 1

Project Category: SBWR System Operations

Detailed Project Description

The existing SBWR system operations manual was written prior to commissioning of the original SBWR system and does not represent the current system, its facilities or the manner in which these are operated by SBWR. Current operations are operator-dependent and are inconsistent among the

This project would prepare an operations manual that encompasses existing and planned SBWR system facilities and modifications to the overall operating approach and strategy. The system operations manual would document customer service and communications protocols, system troubleshooting, emergency operating procedures, and other relevant topics that operators and

Preparation of an updated operations manual should be done prior to or in conjunction with implementation of additional system monitoring stations (Project S6) to represent operating procedures that utilize the additional operational data

The operations manual should include routine maintenance activities, including winter flushing of pipelines, valve exercising, air valve inspections, protective coatings touch up and recoating.

The operations manual should address current system configuration and future modifications that will change and simplify system operations (e.g. Projects D8 and D9). Ongoing operational studies and hydraulic modeling results should also be incorporated into the operations manual

Project Trigger for Implementation

This project is needed at current and future demands and should be done in coordination with other system and operational changes. Ongoing updates to the operations manual will be needed to accommodate future system expansions and modifications as they occur

Benefits Provided by Project

- This project addresses a current lack of standardization in system operating procedures that result in inconsistent system operations. A reliable and efficient operational approach needs to be fully documented and system operators trained to implement the operating procedures.
- Improved operational efficiency and consistency can improve customer LOS by reducing existing

- An updated O&M manual will provide systematic transfer of knowledge as senior operators retire and are replaced with new staff

Fact Sheets – Other Projects

Project Name: S1 – Streamline Customer Service Protocol and Procedures

Estimated Cost: Less than $500,000

Project Priority: 4

Project Category: Customer Service

Detailed Project Description

A significant amount of RWF staff time is spent responding to customer issues.

One of the top customers surveyed indicated there could be better communication of information from SBWR directly to the customers (not via the retailers); specifically communication on changes in water quality that may not constitute an ‘emergency’ but simply a change/variation. These changes/variations in water quality can affect site-specific treatment processes. Without communication, the changes only become apparent when the site-specific treatment processes are affected by the changed water quality (e.g. clogging of RO membranes).

This project would entail conducting a series of workshops between SBWR and its retailer agencies to determine:

a) The customer service needs expected by the retailer’s customers
b) A consistent approach to customer service and communication and the parties responsible for each aspect of customer service

The goal of the meetings and the resulting responsibilities list would be to update communications protocols and procedures and assign roles and responsibilities for SBWR and its retailers. Consistency in point of contact and a coordinated flow of information amongst SBWR, its retailers and their customers is critical to fostering confidence in the customer that its concerns are being considered appropriately. If SBWR transitions into more of a wholesaler/retailer mode, it should be the retailers who are directly responsible for communicating with customers given their current [illegible] (e.g. planned outages). A regular discussion of customer issues and needs for customer communication should be implemented between SBWR and the retailers, either through an existing coordination process or a new activity.

The revised customer service protocols should then be incorporated into a Customer Service element within an updated SBWR Operations Plan. Additional discussion on the updated SBWR Operations Plan is included in Project S5 below. Updated protocols and procedures should be communicated to customers once established and customer service representatives from each assistance in clarifying the procedures. Customer service activities should be appropriately budgeted in the SBWR and retailer operating budgets.

Project Trigger for Implementation

This project addresses current communication issues. Therefore, this project is needed for maintaining LOS at current and baseline system demands.

Benefits Provided by Project

Customer service is a key activity for keeping existing customers satisfied with their recycled water service and for recruiting potential new customers to connect to the recycled water system. By establishing clear delineations of roles and responsibilities, each retail agency, with the support of SBWR, should be capable of keeping customers informed and helping to maintain customer' satisfaction. Customer service also helps to establish the value received for recycled water service; good customer service can mean more customer support when seeking increases in recycled water

Project Name: S2–Implement Next Phase of Asset Management Program

Estimated Cost: Less than $500,000

Project Priority: 4

Project Category: SBWR System Asset Management

Detailed Project Description

The SBWR system has assets that are reaching the end of their expected useful life. The RWF Condition Assessment and the SBWR Condition Assessment documents identify a variety of assets that will reach the end of their expected useful life in 2015 including:

- SCADA and system controls;
- Distribution system valves (60% or more)

- Mechanical, electrical, and control system components at pump stations and reservoirs.

SBWR does not have a comprehensive plan and funding for maintaining and replacing these assets. As the system continues to age, additional investment must be made to plan for renewal and replacement of components to extend service life on a component and system basis.

SBWR has developed an inventory of system assets using a computerized maintenance management system (CMMS), which tracks the maintenance history and costs of all instruments in the system. All critical valves are contained within a GIS system. The next step is to develop an appropriate work plan to maintain each asset and prioritize maintenance. Tasks that should be included in the asset management program include flushing of pipelines to remove old water, valve exercising program to keep valves in good working condition, pipeline replacement (estimated as 9 miles by 2045[1]) and

This project should include validating SBWR's GIS data files to confirm those recycled water pipelines that have been installed (versus planned but not installed) and to develop procedures for adding newly installed pipes to the GIS and asset databases.

Project Trigger for Implementation

This project addresses current maintenance and replacement issues with existing assets. Therefore, this project is needed for baseline and future demands to maintain customer LOS.

Benefits Provided by Project

By actively managing the existing and future assets of the SBWR system, the remaining useful life of system assets can be extended while also providing justification for planning and funding of asset maintenance and replacement.

Project Name: S3 – Seismic Reliability Assessment

Estimated Cost: Less than $500,000

Project Priority: 3

Project Category: SBWR System Asset Management

Detailed Project Description

SBWR has not investigated seismic vulnerabilities of its production and distribution systems and does not have an established design seismic event or post-event level of service goal or expectation. As such, SBWR cannot communicate the reliability of the system to current or potential customers

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[1] CH2MHill (2010)

This project would include performing a seismic reliability investigation of the SBWR production and distribution system, focusing on key infrastructure pieces (e.g. above ground storage reservoirs, large transmission lines). A key component of the assessment will be the development of the level of service goals SBWR wants to achieve post-event and selection of a design seismic event. The result of this project should be a seismic improvement program that describes a prioritized list of

Project Trigger for Implementation

This project addresses a current lack of seismic design and performance criteria related to seismic reliability for the SBWR system. Therefore, this project is needed at baseline and future demands. Implementation of this project will not impact LOS, but will provide a basis for planning and implementation of seismic reliability projects that will enhance LOS in a post-earthquake

Benefits Provided by Project

This project addresses a current gap in knowledge related to the seismic vulnerabilities of the SBWR system and would provide a basis for developing projects to address critical vulnerabilities that have a large consequence of failure related to LOS.

Project Name: S4 – Obtain Program Support Equipment

Estimated Cost: Less than $500,000

Project Priority: 1

Project Category: SBWR System Operations

Detailed Project Description

Currently SBWR staff often use their own vehicles to respond to assignments. This project would obtain vehicles, radios, tools, etc. needed for staff to respond to pump station assignments.

Project Trigger for Implementation

This project addresses a current need.

Benefits Provided by Project

This project enhances the ability to respond to pump station normal operation and emergency conditions by providing operators with needed support equipment.

Project Name: S6 - Additional SBWR Distribution System Monitoring Stations

Estimated Cost: $1-$4M

Project Priority: 3

Project Category: SBWR System Operations

Detailed Project Description

SBWR system lacks in-system real-time monitoring data that would be helpful in optimizing system operations. There are three pressure monitoring stations with PLCs in the system – at Milpitas, San José and Santa Clara – but these stations do not provide enough information to understand what is happening throughout the 103-mile long pipeline system. There are no remote water quality

This project would evaluate locations and types of monitoring devices that could be added to the SBWR system to allow for better day-to-day control of the system as well as provide early detection of system trouble. The monitoring devices that should be considered include:

- Chlorine analyzers
- Conductivity analyzers
- Flow meters, specifically at retailer connections
- [illegible]

A recommended list of monitoring station locations including the full range of sensing devices at each monitoring station would then be implemented in a single construction project or in phases based on the priority of most useful to system operators.

Project Trigger for Implementation

This project addresses current operating data gaps. This project is needed at baseline and future demands to maintain customer LOS and should be done in conjunction with the upgrade to the SBWR system controls (Project P9).

Benefits Provided by Project

- Provides real-time system monitoring data to help optimize system operations and provide information to manage the 103-milelong pipeline system
- Provides advanced trouble detection in system and opportunity for operator intervention prior to [illegible]

- Would provide information to validate retailer demands, identify system trouble, and better account for system lost water/revenue.

Project Name: S7 - Investigate Additional Backup Supplies

Estimated Cost: Less than $500,000

Project Priority: 4

Project Category: Utility Management Planning and Budgeting

Detailed Project Description

SBWR relies upon a single source of recycled water, the RWF, which leaves the system vulnerable if/when the RWF cannot produce recycled water meeting Title 22 water quality requirements. Some customers have available backup water supplies on site (e.g. groundwater wells, connection to a potable water system) but there is no large capacity system-wide backup supply that could

This project would consist of investigating potential sources and the feasibility of implementing a significant back up water supply that would allow SBWR to operate during a process upset or outage at the RWF. SBWR would explore potential opportunities to develop groundwater supplies, retailer potable connections and other sources of suitable back up water supply that could meet a large

The goal for any back up supply project would be to bring supplemental water into the SBWR system at one or more high volume locations (e.g. pipeline larger than 24 inches), ideally into one of the SBWR storage tanks. Should a feasible back up supply opportunity present itself through this project, SBWR could then define a follow-on project to further define and implement a backup

Project Trigger for Implementation

This project addresses the current lack insufficient back up water supplies for SBWR and should be undertaken in the near-term. Additional efforts would be needed to fully define and implement a project

Benefits Provided by Project

Diversifying the water supplies available to SBWR would increase supply reliability in the event RWF supply is interrupted, and would help maintain a high-level of service during outages and emergencies at the RWF. Having a system supply backup would also provide flexibility for SBWR to

Project Name: P1-Address Condition Issues from Condition Assessments Reports

Estimated Cost: It is assumed that the RWF condition assessment projects will be funded as part of the RWF Master Plan implementation, so costs were not developed for this project.

Project Priority: N/A To be implemented as part of the RWF Master Plan.

Project Category: Improvements to Existing Infrastructure

Detailed Project Description

Previously completed condition assessments outlined a number of significant deficiencies within the RWF boundaries. While some issues have been addressed since the completion of the reports, many remain in an at risk condition they were in several years ago.

This project would include addressing the deficiencies outlined in the RWF Condition Assessment reports as summarized in Table 1. Examples of projects to be completed include upgrades for compliance with building and safety codes, seismic upgrades, electrical component upgrades,

Project Name: P4 –Parallel Pipeline to TPS

Estimated Cost: $10M - $12M

Project Priority: 2 (priority would drop if Zone 1 storage was added)

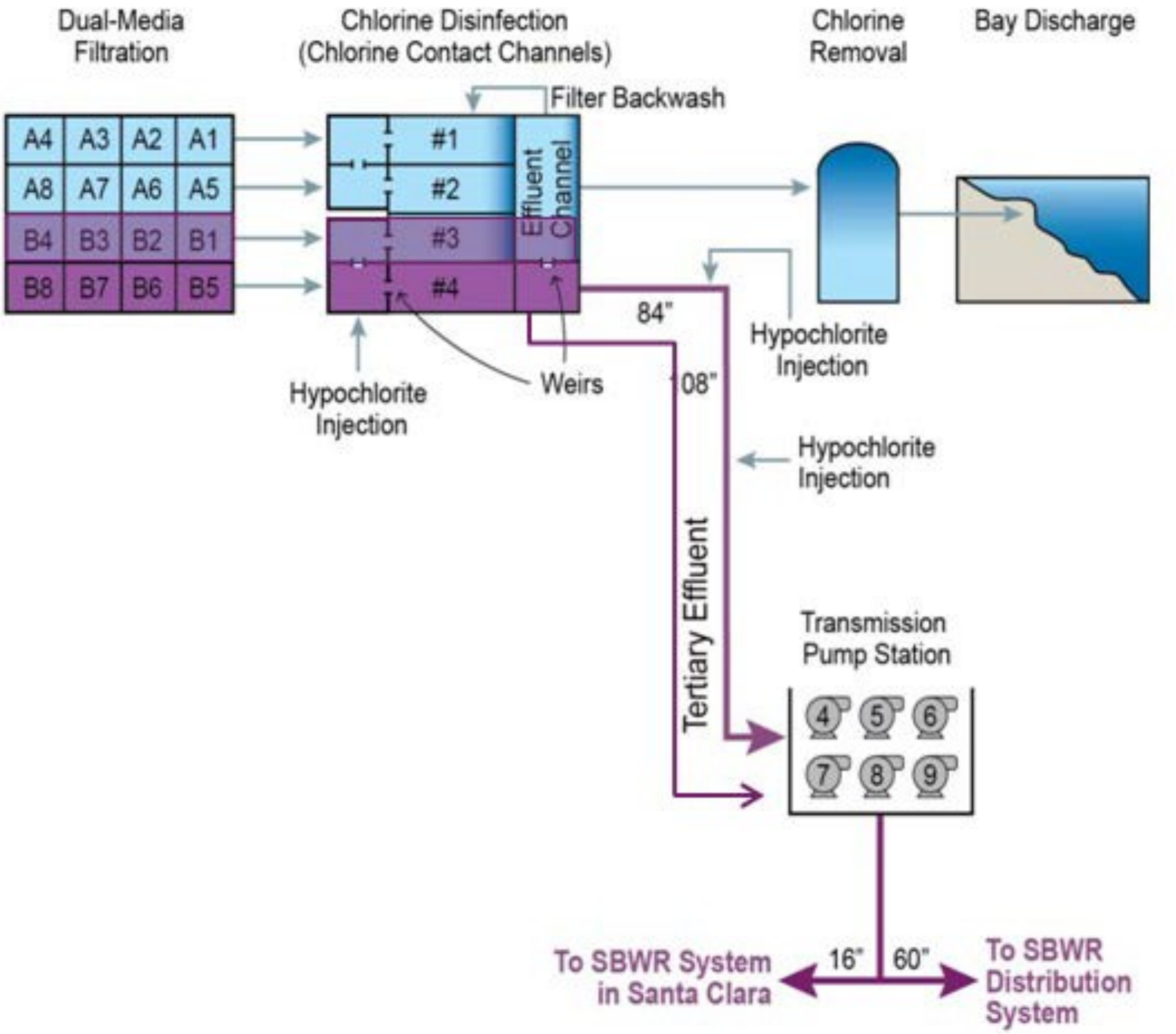
Project Category: New Infrastructure

Detailed Project Description

The current tertiary recycled water chlorination process represents a single point of failure vulnerability. The existing 84-inch/108-inch pipeline from CCC#4 to TPS serves a dual purpose of conveyance and providing chlorine contact time. The single pipeline has limited to no ability to be taken out of service for inspection, maintenance or rehabilitation. In the event the 84-inch/108-inch pipeline was out of service, the entire recycled water flow to TPS would cease until the pipeline was repaired. Plant staff has also indicated that silt accumulates at the low points along the pipeline and

In order to eliminate the single point of failure vulnerability, a second chlorination process train could be built, as illustrated in Figure 4b-17. This would consist of retrofitting CCC#3 to facilitate recycled water treatment and designing and constructing a parallel pipeline from the filter include new hypochlorite dosing points, instrumentation, and other elements to ensure regulatory compliance with recycled water requirements in a new pipeline. The retrofit of CCC#3 is not included in the project description as it is assumed that this project is already being addressed.

Figure 4b-3: Project Schematic



Two pipeline alternatives are presented in Table 4b-9. The 108-inch parallel pipeline, Alternative A, is based on providing 100% redundancy for the existing pipeline. The 54-inch parallel pipeline, Alternative B, is based on providing sufficient disinfection capacity within the new parallel pipeline to meet an estimated 2015 average winter demand of 10 MGD, allowing the main pipeline to be taken offline during the winter months; the sizing assumes that in the winter one chlorine contact and the remaining 30 mgd sent to the RWF outfall. With both CCC#3 and CCC#4 in full recycled water production, the 54-inch pipe proposed under Alternative B adds 19.5 MGD of new flow capacity to the SBWR production system, yielding a total flow capacity of 68 MGD.

Table 4b-5: Parallel Pipeline Alternatives

Alt	Design Criteria	Nominal Pipe Size (in)	Number of Chlorine Contact Channel(s)	New Flow Capacity (MGD)	Existing System Capacity (MGD)	SVAWPC Flow Capacity (MGD)	Total Flow Capacity (MGD)
A	Addition of a parallel 108-inch Pipe	108	2	40.5	40.5	8.0	89
B	Addition of a parallel 54-inch Pipe	54	2	19.5	40.5	8.0	68

Notes:

1. *Pipeline and chlorine contact channel modal factor assumed to be 0.95 and 0.79, respectively based on baffling efficiency values from SBWR Operations Manual.*
2. *Capacity of the existing system at 100 minute modal contact time is 40.56 MGD.*
3. *New pipeline assumed to be 4,310 ft long, matching the existing 84-/108-inch pipeline length.*
4. *The new flow capacity assumes that CCC#3 has been converted to recycled water production.*

The recommended project is the 54-inch alternative since it provides sufficient capacity to meet demands under the projected 2015 baseline demands plus commitments.

Project Trigger for Implementation

This project addresses current single point of failure issue. Therefore, this project is needed at current demands.

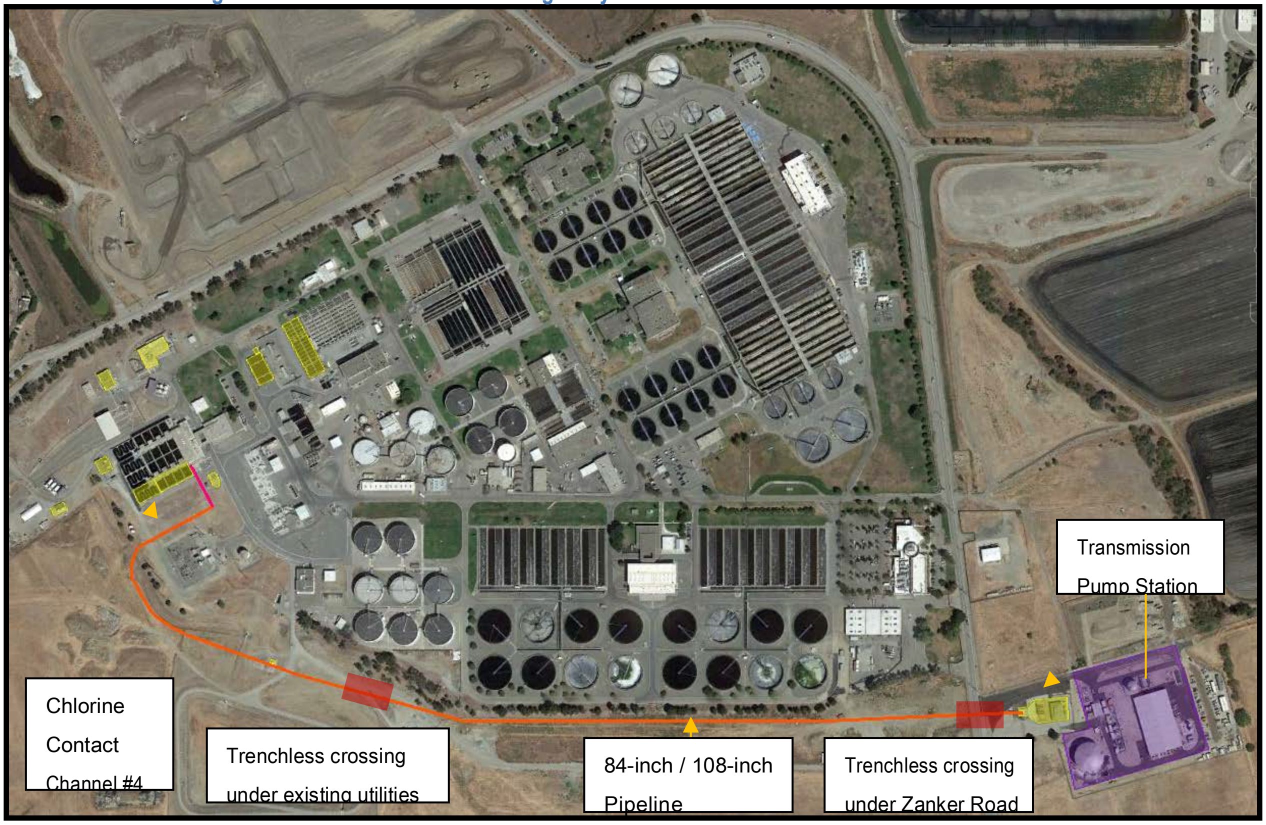
Benefits Provided by Project

This project reduces the single point of failure vulnerability of the chlorination process and provides additional chlorination capacity to meet future increases in demand. The project would allow a pipeline to periodically be taken out of service for inspection, maintenance and rehabilitation. The maintenance and inspection activities during lower flow winter months will minimize/eliminate the consequences of unanticipated failures of the existing 108-inch pipeline. With the conversion of CCC#3 to recycled water treatment, the addition of a parallel pipeline would also increase the

Other

Existing infrastructure and soil conditions pose construction challenges for this project. The existing 84-/108-inch pipeline was installed using two sections of trenchless construction. One section crossed under existing influent sewer lines including an 84-inch influent sewer line. The other trenchless section crossed under Zanker Road which also contains an 84-inch influent sewer line. The parallel pipeline would be required to cross these same utilities and would also be constructed using trenchless methods. These trenchless crossings within what is assumed to be Bay mud add

Figure 4b-4: SJ/SC RWF – Existing Recycled Water Production Facilities


Transmission Pump Station
Chlorine Contact Channel #4
Trenchless crossing under existing utilities
84-inch / 108-inch Pipeline
Trenchless crossing under Zanker Road

The consequence of not implementing this project would be that the SBWR system remains vulnerable to shutdowns should the existing 84-inch/108-inch ever be required to be taken out of service. Additionally, because the capacity of the existing system is limited to 40.5 mgd at a 100 minute modal contact time, or 44.3 MGD assuming a more aggressive 90 minute modal contact time, without this project, another project is needed to meet the projected 2015 peak recycled

Project Name: P5 – Storage at TPS

Estimated Cost: $15 M - $18 M

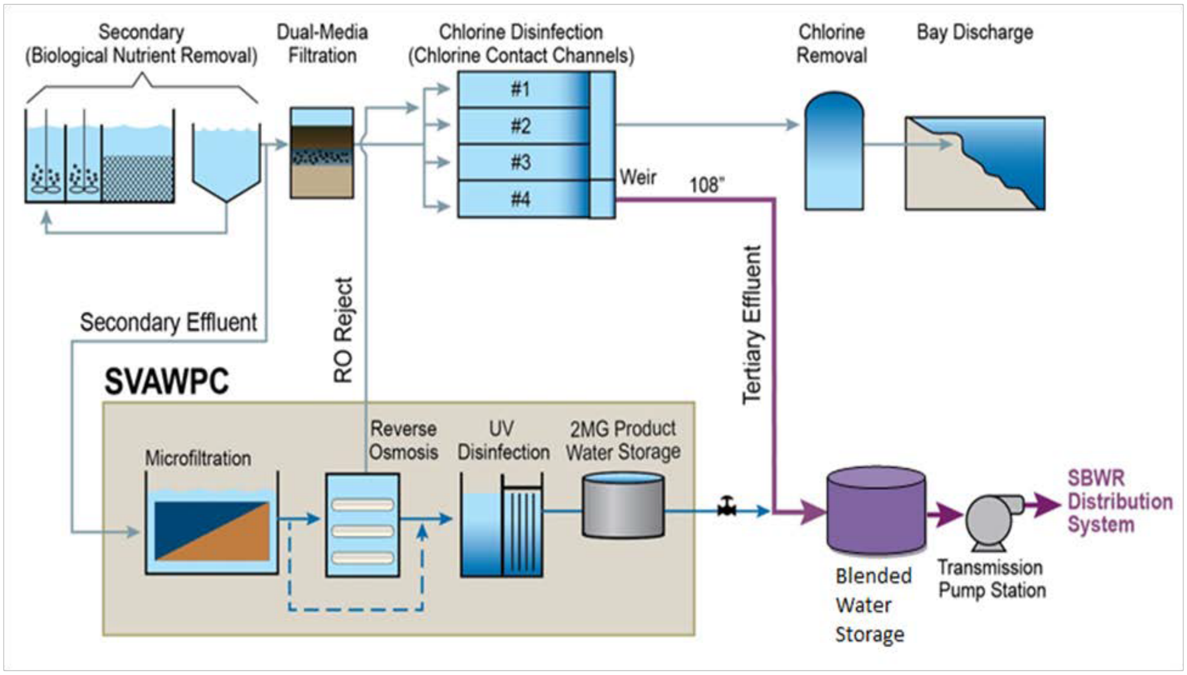
Project Priority: 1 (priority would drop if another storage project was implemented instead)

Project Category: New Infrastructure

Detailed Project Description

The project includes installation of recycled water storage just upstream of TPS such that TPS can pump recycled water without being coupled to the recycled water production process, as illustrated in Figure 4b-19. The existing TPS wet well provides the only existing recycled water operational storage between the tertiary production process and TPS, and its capacity is limited. Therefore, the production rate through the filters and the TPS pumping rate can each directly affect the other under certain operating conditions (i.e. TPS pumping cannot exceed recycled water production rate; filtered water that is not pumped by TPS is lost to the outfall reducing the daily volume of the filter production). An upset or shutdown of the tertiary recycled water production process results in

Figure 4b-5: Project Schematic



In addition, the minimal on-site storage makes salinity control more challenging since blending the RO permeate with the tertiary effluent must occur within the small TPS wet well and the blending ratio must constantly adjust as the TPS flow rate changes. Installation of a tertiary effluent storage tank immediately upstream of TPS would decouple the production facilities from the pumping operation and allow the production facilities to operate at a constant flow rate. It would also provide a location to blend the RO permeate and the tertiary effluent in a controlled, stable manner

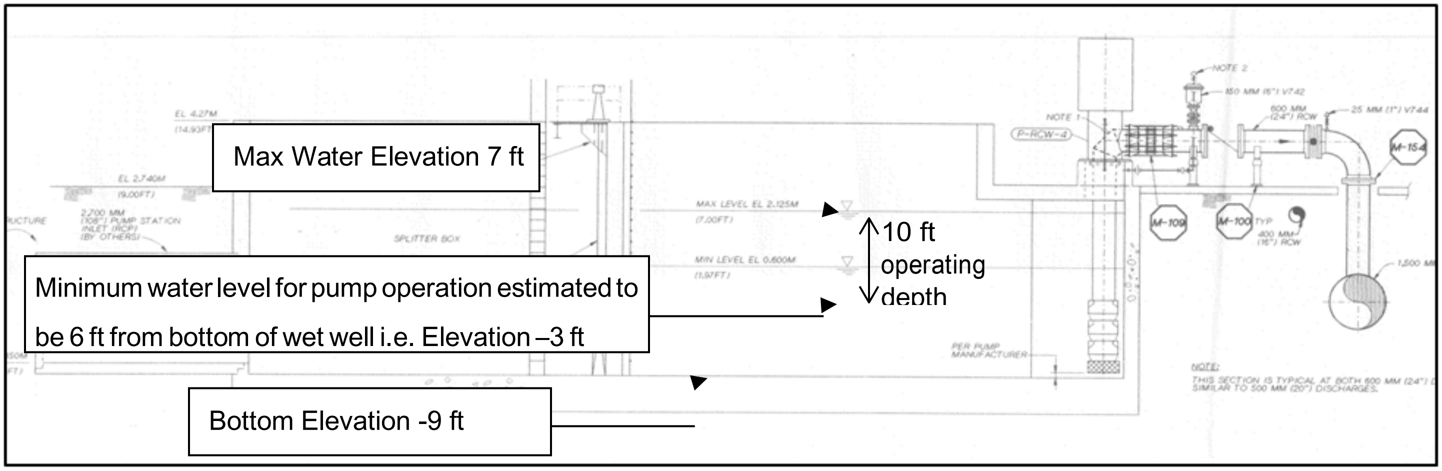
Two storage options that could be considered are:

1) Buried reservoir matching allowable existing TPS operating levels (allows for continued use of TPS)
2) Buried reservoir with increased operating water depth than the existing TPS allows (requires

Option 1 assumes the existing allowable TPS operating level is 10 feet based on the design maximum water elevation of 7 feet, the wet well bottom elevation of –9 feet and an estimated 6 feet of water above wet well bottom for pump submergence (see Figure 4b-20)

Option 2 assumes a 20 foot operating water depth that would require a new TPS to accommodate the additional 10 feet of water depth for storage. Under Option 2 it may be possible to modify the existing TPS with longer shafts and columns

Figure 4b-6: Annotated TPS Section View Record Drawings


Max Water Elevation 7 ft
10 ft operating depth
Minimum water level for pump operation estimated to be 6 ft from bottom of wet well i.e. Elevation –3 ft
Bottom Elevation -9 ft
MAX LEVEL EL 2.125M (7.00FT)
MIN LEVEL EL 0.600M (1.97FT)
SPLITTER BOX
PER PUMP MANUFACTURER
NOTE:
THIS SECTION IS TYPICAL AT BOTH 600 MM (24") SIMILAR TO 500 MM (20") DISCHARGES.

For a given storage volume, Option 1 will require more concrete than Option 2 because the constraint on the depth of the tank results in a less efficient surface area to volume ratio. However, Option 2 will require more shoring and deeper excavation in what is assumed to be Bay mud

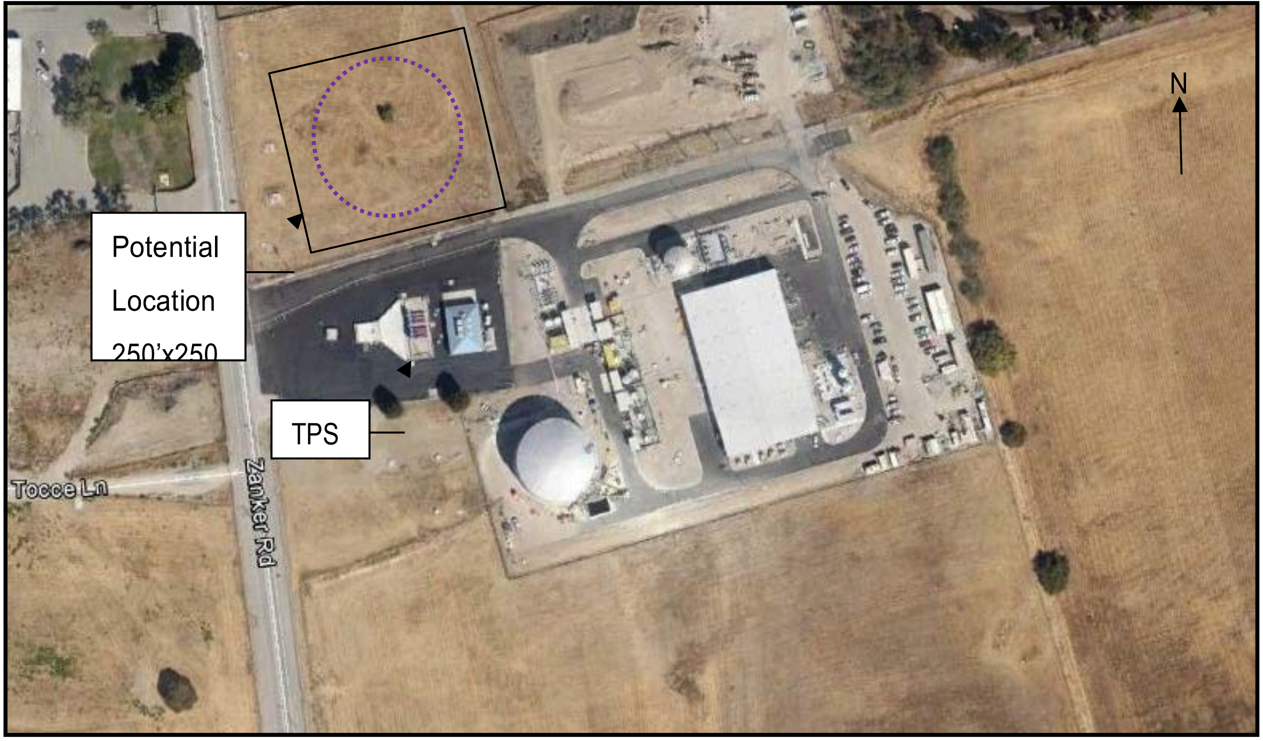
Table 4b-10 presents the required inside tank diameter for three storage volumes – 2.5 MG, 5 MG and 10 MG – for each of the storage options. To provide uniform 24-hour production under the 2015 baseline and 2015 baseline plus commitments demands, roughly 2.5 MG of storage would be sufficient. To allow for uniform production, a 2.4 MG tank would be needed for the 2015 baseline and 2.6 MG would be needed for the 2015 baseline plus commitments. However, to accommodate planned and unplanned shutdowns of the production facilities, greater storage volume would be

Table 4b-6: Storage Sizing Options for near TPS

Option	Storage Volume (MG)	Operating Water Depth (ft)	No. of Tanks	Required Diameter (ft)
Option 1A	2.5	10	1	206
Option 1B	5	10	1	292
Option 1C	10	10	2	292
Option 2A	2.5	20	1	146
Option 2B	5	20	1	206
Option 2C	10	20	2	206

Figure 4b-21 identifies a potential location for a new TPS storage tank. This location is ideal because of its close proximity to TPS and because the area is City owned. This location appears to have sufficient area to accommodate a 2.5 MG tank matching the existing TPS operating level or up to a 5 MG tank with a 20 foot operating depth. While the larger storage volumes are desirable in that they challenging. Alternate locations would have to be considered for the other storage scenarios.

Figure 4b-7: Potential Tank Location



Project Trigger for Implementation

This project addresses operational storage deficiencies at both current and future demands as well as water quality issues. This project should be considered for implementation in the near term to achieve maximum customer satisfaction with the newly available blended recycled water.

Benefits Provided by Project

This project address two issues at TPS: 1) operational challenges associated with the linkage between TPS pumping and recycled water production and 2) salinity control of the blended product water associated with diurnal demands.

Operational storage at the RWF would enhance recycled water production flexibility and decouple the production process from TPS operation. Storage would also help to increase the total daily volume of recycled water produced by reducing the production peaking factor, i.e. all of the recycled water that was produced could be stored and used, rather than overflowing back to the RWF outfall during low demand periods. Storage would support shutdowns of the recycled water production process without TPS shutdown. This shutdown would allow for routine maintenance, cleaning and

Operational storage would also provide a reservoir of blended water as a buffer before recycled water is delivered to the distribution system. By storing blended recycled water in a reservoir, a more consistent water quality range could be maintained, resulting in more precise salinity control

Other

The consequence of not implementing this project would be that the production facilities remain linked to TPS, meaning the production facilities must be able to match the peak recycled water demands. Since the peak capacity of the production facilities is currently limited to 39.7 mgd and 2015 demands are projected to reach a peak demand of 46 mgd, without this project, other projects

The drawback of adding storage to the SBWR at the RWF as opposed to within Zone 1 is that TPS remains the only water supply source for Zone 1. Also, TPS would still be subject to the peak demands of the distribution system.

Project Name: P7 - Transmission Pump Station (TPS) Electrical Redundancy

Estimated Cost: Less than $500,000

Project Priority: 2

Project Category: New Infrastructure

Detailed Project Description

The single electrical feed to TPS has no reliable backup system and represents a single point of failure vulnerability.

The goal of this project is to install a backup electrical supply to TPS that will allow the TPS to maintain normal operations in the event of damage or interruption of electrical service on the existing single feed. Options for enhancing the electrical reliability of the TPS include 1) installing a second electrical feeder to the existing TPS switchgear or 2) installing a standby generator. The project would identify the preferred backup supply method and design and install the new backup

Project Trigger for Implementation

This project addresses a single point of failure at current recycled water demands. Therefore, this project should be implemented immediately.

Benefits Provided by Project

The second feeder or standby generator would address the single point of failure vulnerability.

Project Name: D1b - SBWR Renewal/Replacement Projects 2016-2020

Estimated Cost: $20M-$23M

Project Priority: 4

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

The 2010 SBWR Condition Assessment report outlines a number of projects needed to maintain and extend the expected service life of SBWR distribution facilities. While some of the recommendations of the SBWR Condition Assessment have been implemented, other recommendations have not, increasing risk of component or facility failure that would impact customer LOS. Project D1 includes two phases: D1a-SBWR Renewal/Replacement Projects 2014-2015 and D1b-SBWR Renewal/Replacement Projects 2016-2020 – that would include planning and implementation of recommendations from the SBWR Condition Assessment report.

Project D1b focuses on projects that the SBWR Condition Assessment recommended for implementation during the five-year period from 2016-2020.

Figure 4b-11 summarizes the individual components of this project and the associated cost of each:

Table 4b-11: Summary of Renewal/Replacement Recommendations from SBWR Condition Assessment

Facility	Range of Renewal/Replacement Projects	Cost
Pump Station 5	• Rebuild booster pumps • Replace booster pump expansion joints • Replace pressure indicators • Replace RTU • Replace expansion tank • Correct site drainage issues	• $640,000
Pump Station 8	• Rebuild pumps • Replace air compressor • Replace pressure switches • Rehabilitate irrigation system and vegetation	• $430,000
Pump Station 11	• Rebuild booster pumps • Replace air compressor • Replace flow meters • Replace pressure switches	• $700,000
Yerba Buena Reservoir	• Rebuild or replace valve actuators • Rehabilitate irrigation system and site vegetation	• $180,000
Zone 3 Reservoirs	• Reseal pavement • Rehabilitate/replace asphalt curbs	• $90,000
Pipeline Valves	• Replacement of 160 isolation valves and 106 control valves	• $9,630,000

Note: Costs are based on capital costs in the 2010 SBWR Condition Assessment escalated to current ENR.

Project Trigger for Implementation

This project is needed at baseline and future demands to maintain customer LOS.

Benefits Provided by Project

The project addresses multiple existing vulnerabilities within the SBWR distribution system related to component conditions and deficiencies (as observed in 2010) that could result in failure or reduced operational effectiveness.

Project Name: D3 - Valve Installation

Estimated Cost: $1M - $4M

Project Priority: 3

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

The existing distribution system was constructed with few line isolation valves resulting in long lengths of pipeline needing to be isolated and dewatered in order to make new connections to the pipeline and perform maintenance and repairs on the pipeline. This extends the duration of

This project would consist of installing line isolation valves such that the system outages for maintenance and repair work can be reduced to a reasonable time to accommodate closing valves for line isolation, dewatering the pipeline reach, performing the maintenance or repair work, filling the pipeline reach and reopening the isolation valves. A maximum dewatering time criterion should

The estimated cost for this project is based on spacing valves on the 60-inch to 20-inch pipelines to allow dewatering to be completed within one 8-hour operator shift. The smaller diameter pipelines are assumed to have sufficient valves

Project Trigger for Implementation

This project is needed at current and baseline demands to maintain customer LOS.

Benefits Provided by Project

The project addresses the lack of sufficient isolation valves in the distribution system.

Project Name: D4 - Address Transients between Pump Station 5 and Pump Station 8

Estimated Cost: Less than $500,000

Project Priority: 3

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

Operators report that transients may be occurring in Zone 2 between Pump Station 5 and Pump Station 8. Pressure surges can result in less than optimal operation and could lead to equipment and piping failures

The project consists of performing an investigation to determine the magnitude of the transients and cause. Existing surge protection equipment should be inspected and verified as functioning properly. As documented in the SBWR Condition Assessment, the pressure spikes may be caused by pump station operating procedures, which are currently being reviewed by SBWR. Pump station operating procedures and surge control operations should be established to eliminate excessive pressure spikes in the system. The operation of the existing bypass check valve should be

Project Trigger for Implementation

This project addresses current operational issues. Therefore, the project is needed under baseline and future system demands to maintain customer LOS.

Benefits Provided by Project

This project would address vulnerabilities caused by pressure spikes, which could result in facility downtime due to equipment and piping failures and reduced service life expectancies.

Project Name: D7- Evaluation and As-Needed Replacement of Customer Meters

Estimated Cost: Less than $500,000

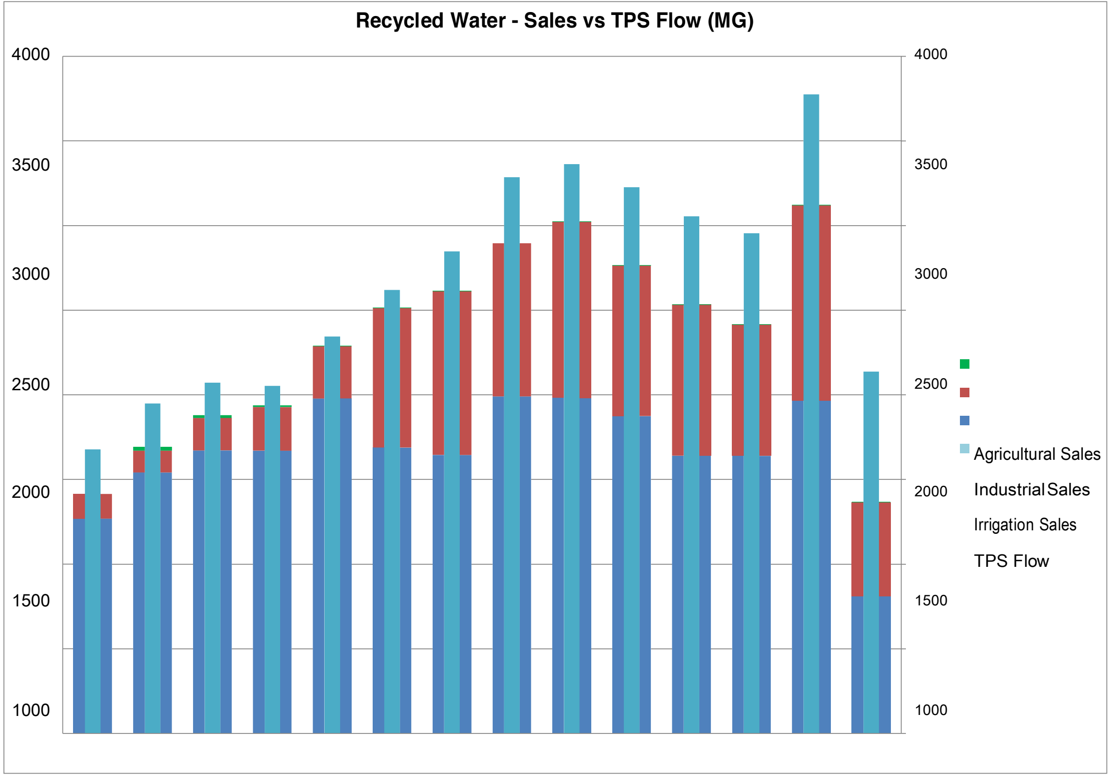
Project Priority: 4

Project Category: Improvements to Existing SBWR Infrastructure

Detailed Project Description

The existing customer meters are used by the SBWR retailers to measure recycled water use and bill customers for the water used. Retailers regularly report total customer metered usage to SBWR. SBWR also totalizes the volume of recycled water pumped at TPS. The customer meter use and the

Figure 4b-23: Historic Recycled Water Demand



Note: *The figure shows a comparison of retail sales records and TPS flow data. TPS data indicate significantly higher use than retail sales. It is unknown if the gap is due to inaccurate TPS flow meters, lost water, or inaccurate retail flow meters.*

The project consists of developing and implementing a systematic meter inspection and calibration program. The calibration program would be implemented by the retailers with support from SBWR. Consideration should be given to adding automated meter reading capabilities to customer meters, which would make meter reading more efficient and potentially provide retailers with near real-

This project would result in a valuable check on metering accuracy and water balance within the SBWR distribution system and would ensure equitable billing for customer water use with a high degree of confidence

Project Trigger for Implementation

This project addresses current system operational and supply reliability. Therefore, the project is needed under baseline and future system demands to maintain customer LOS.

Benefits Provided by Project

This project would address vulnerabilities associated with inaccurate metering of recycled water usage, which could become a customer confidence issue.

Another potential benefit of the project could be increased revenue. The customer meters are the basis for SBWR billing. If the retail meters are found to be under-reporting, that implies SBWR has delivered more water than the amount for which SBWR has charged its retailers. If that were the

Other

While this project has been given a low project priority by SBWR staff, it should be recognized that the timing of other high priority projects might be biased by the uncertainty over the actual recycled water demand. Calibration of the customer meters could also serve as a means to verify the accuracy of the TPS flow meter, which is the basis for the Strategic Plan reliability assessment. The reliability assessment used the existing TPS flow data as the basis for future recycled water projections because that approach provided a more conservative planning basis than using the retailers' records. If the gap between the TPS flow records and SBWR sales records turns out to be a result of over-reporting from

Project Name: D8 – Additional Pipeline Looping

Estimated Cost: (see Project Fact Sheets D8a through D8h)

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

The SBWR distribution system was originally developed as a branch distribution system to serve irrigation customers. Looping was generally avoided as too costly. As a result, customers are vulnerable in the event of a pipeline break upstream of their location unless a pipeline loop exists around their location. In particular, customers served by the City of Milpitas and San José Water Company and customers in the south end of the system have limited pipeline redundancy. The City of Santa Clara does have pipeline looping covering most of the system; however additional pipelines

From a system perspective, SBWR effectively has the single 60-inch to 42-inch Zone 1 pipeline to convey recycled water from TPS to the entire south end of the system. The project consists of a suite of projects that add looping (redundant) pipelines to improve the conveyance reliability through the system. Several looping pipeline alternatives are depicted in Figure 4b-24 and described in Table 4b-12. Pipelines A, B, C, and D are targeted to provide additional conveyance redundancy to [illegible] maintenance activity occur. Pipelines E through H are intended to provide redundancy to the existing SBWR backbone pipeline, benefiting all retailers and customers.

Figure 4b-24: Additional Looping

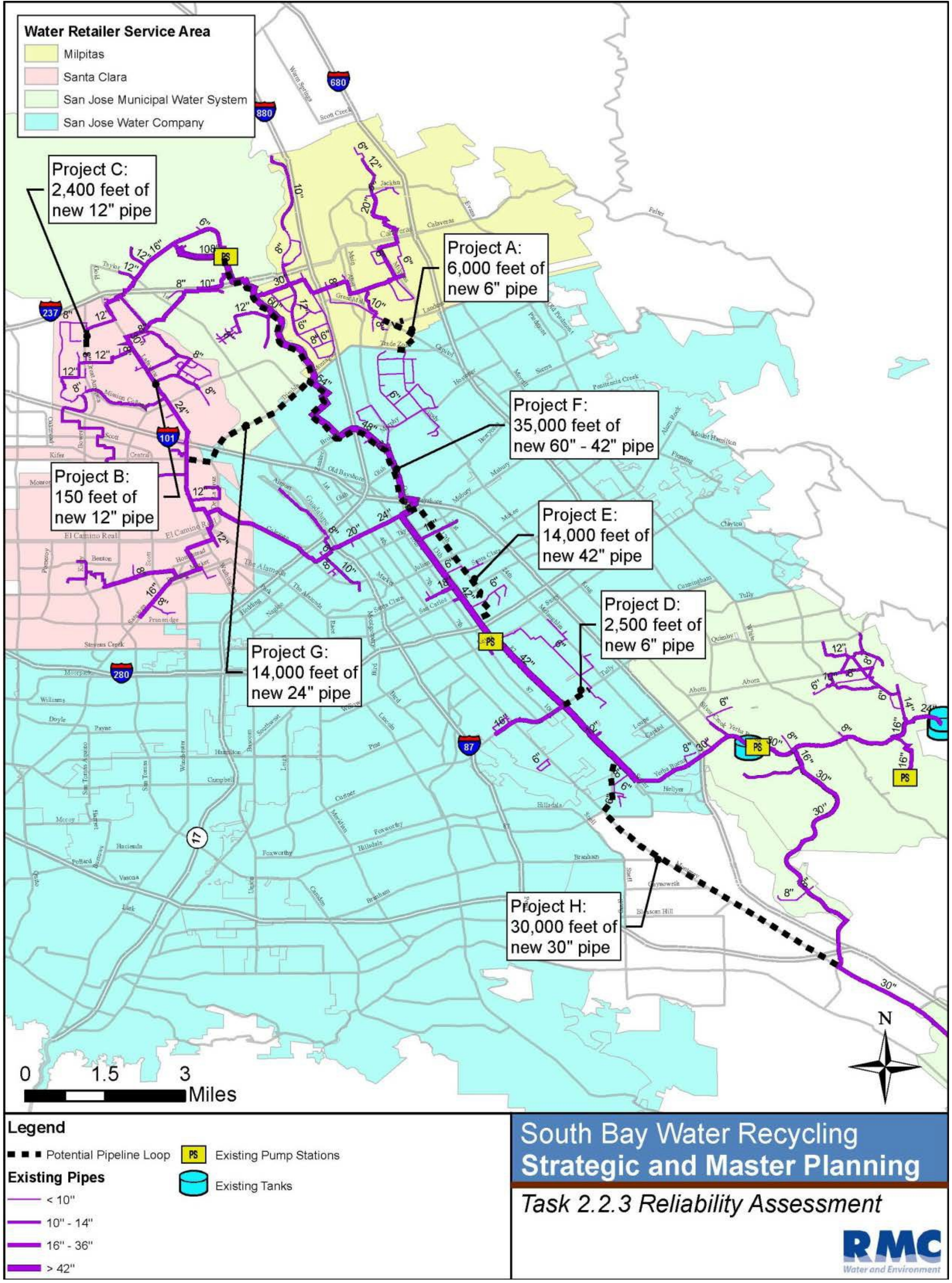

Water Retailer Service Area
Milpitas
Santa Clara
San Jose Municipal Water System
San Jose Water Company
Project C: 2,400 feet of new 12" pipe
Project A: 6,000 feet of new 6" pipe
Project F: 35,000 feet of new 60" - 42" pipe
Project B: 150 feet of new 12" pipe
Project E: 14,000 feet of new 42" pipe
Project D: 2,500 feet of new 6" pipe
Project G: 14,000 feet of new 24" pipe
Project H: 30,000 feet of new 30" pipe
680
880
237
101
280
87
17
N
0
1.5
3
Miles
Legend
Potential Pipeline Loop
PS Existing Pump Stations
Existing Tanks
Existing Pipes
< 10"
10" - 14"
16" - 36"
> 42"
South Bay Water Recycling
Strategic and Master Planning
Task 2.2.3 Reliability Assessment
RMC
Water and Environment

Table 4b-12: Potential Looping Pipelines[1]

Pipeline	Concept Description
A	Install new pipeline in Great Mall Parkway and Montague Expressway from San José Water Company's recycled water system to connect to the City of Milpitas system. New pipeline would include a meter at the point of connection (refer to Project S6) to the Milpitas system. Pipeline construction should be coordinated with retail agencies to
B	Install new pipeline to connect the existing 24-inch trunk line on Lafayette Street to a 12-inch recycled water pipeline located on Agnew Drive to improve reliability for City of
C	Install new piping on Great America Parkway from a 12-inch pipeline just north of San Tomas Aquino Creek across Tasman Drive to connect to a 6-inch pipeline just south of Tasman Drive. This would improve reliability for City of Santa Clara customers in the
D	Install new pipeline to connect the existing backbone pipeline on Senter Road to the San José Water Company main pipeline at Saddlewood Drive. This would improve reliability
E	Install parallel trunk pipeline from East Hedding Street to Margaret Street (north of 280). This pipeline would provide additional reliability in the case of a repair on the
F	Install parallel backbone pipeline from TPS to East Hedding Street. The pipeline would provide additional conveyance reliability and operational flexibility to accommodate
G	Install pipeline from backbone pipeline along Trimble Avenue to Central Ave. in Santa Clara. This pipeline would provide conveyance reliability to Santa Clara customers and
H	Install pipeline from backbone pipeline at Senter Road and Hillsdale Avenue along Hillsdale then south along Monterey Highway to existing MFC pipeline.

1. *Descriptions are concepts for alignment and sizing and require additional refinement and analysis.*

These looping projects are costly and require additional development and analysis to create optimized alternatives. Each provides a benefit in terms of operational flexibility and customer LOS.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

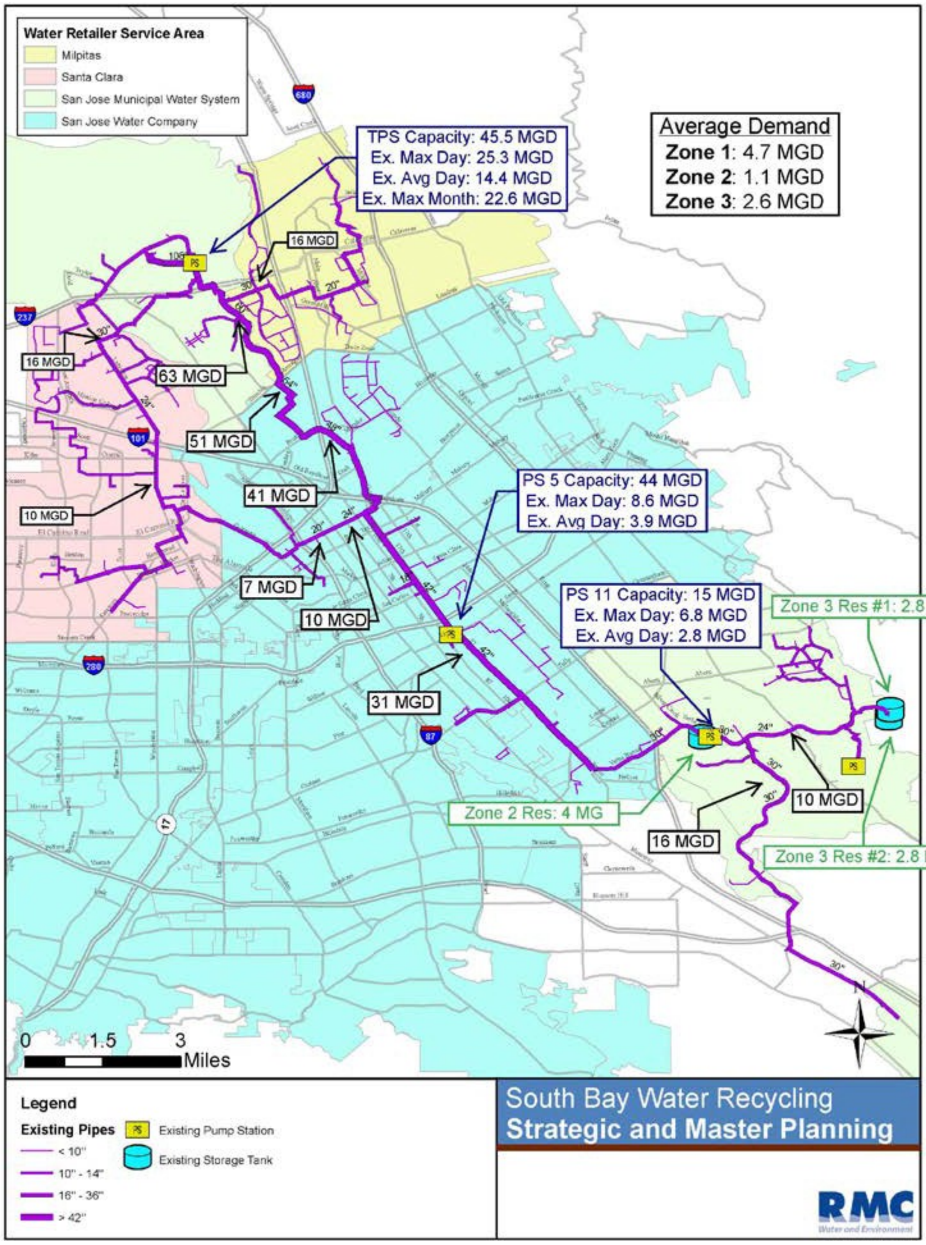
As additional demand is served by SBWR, the existing system will become more stressed in meeting customer LOS. A preliminary analysis of the existing system capacity was performed to determine an approximate threshold demand condition that would trigger capacity improvement projects, which could include expanding pump stations, adding system storage, and constructing additional pipeline loops (all in addition to facilities required for serving water to the new demand locations).

assuming a velocity of 5 ft/s. The results of this analysis are approximate and should be refined through modeling of the system.

Benefits Provided by Project

This project addresses the vulnerability of customer service interruptions due to conveyance system outages. Some alternatives also address operational constraints for serving areas of the system when part of the system is out of service.

Figure 4b-25: Existing System Capacity Analysis Summary



Project Name: D8a – Looped Milpitas Supply

Estimated Cost: $1M-$4M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a new pipeline in Great Mall Parkway and Montague Expressway from San José Water Company's recycled water system to connect to the City of Milpitas system. The new pipeline would include a meter at the point of connection to the Milpitas system. Pipeline construction should be coordinated with retail agencies to take advantage of recycled water

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

The City of Milpitas has commented that they have a low level of service due to lack of infrastructure. This project would help to improve LOS to customers in Milpitas's service area.

Project Name: D8b – Additional Santa Clara Looping – Lafayette Street to Agnew Drive

Estimated Cost: Less than $500,000

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a new pipeline to connect the existing 24-inch trunk line on Lafayette Street to a 12-inch recycled water pipeline located on Agnew Drive.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

The project would improve reliability for City of Santa Clara customers in the area.

Project Name: D8c – Additional Santa Clara Looping – Great America Parkway

Estimated Cost: $1M-$1.5M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install new piping on Great America Parkway from a 12-inch pipeline just north of San Tomas Aquino Creek across Tasman Drive to connect to a 6-inch pipeline just south of Tasman Drive.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

This would improve reliability for City of Santa Clara customers in the area.

Project Name: D8d – Looped SJWC Supply

Estimated Cost: Less than $500,000

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a new pipeline to connect the existing backbone pipeline on Senter Road to the San José Water Company main pipeline at Saddlewood Drive.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project

Benefits Provided by Project

This would improve reliability for San José Water Company customers along N 17th Street.

Project Name: D8e – Redundant Backbone Pipeline from East Hedding to 280

Estimated Cost: $16M-$19M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a parallel trunk pipeline from East Hedding Street to Margaret Street (north of 280). This trunk line could also be connected to the parallel pipeline constructed as part of the storage project (see Project D9)

The estimated project cost assumes the parallel pipeline provides 100% redundancy. The pipeline could be sized smaller to reduce the cost while still achieving some benefits of redundancy.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project

Benefits Provided by Project

By providing redundancy to the existing SBWR backbone pipeline, this project benefits all retailers and customers.

Project Name: D8f – Redundant Backbone Pipeline from TPS to East Hedding

Estimated Cost: $53M-$56M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a parallel backbone pipeline from TPS to East Hedding Street. The pipeline would provide additional conveyance reliability and operational flexibility to accommodate pipeline shut downs for maintenance and repairs.

The estimated project cost assumes the parallel pipeline provides 100% redundancy. The pipeline could be sized smaller to reduce the cost while still achieving some benefits of redundancy.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

By providing redundancy to the existing SBWR backbone pipeline, this project benefits all retailers and customers.

Project Name: D8g – Fourth Santa Clara Supply Loop

Estimated Cost: $9M-$12M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a pipeline from the backbone pipeline along Trimble Avenue to Central Avenue in Santa Clara.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

This pipeline would provide conveyance reliability to Santa Clara customers and along the backbone pipeline between Trimble and East Hedding.

Project Name: D8h – Redundant Backbone Pipeline from Senter Road to Highway 85

Estimated Cost: $24M-$27M

Project Priority: 4

Project Category: New Infrastructure

Detailed Project Description

This project would install a pipeline from backbone pipeline at Senter Road and Hillsdale Avenue along Hillsdale then south along Monterey Highway to existing MEC pipeline.

The estimated project cost assumes the parallel pipeline provides 100% redundancy. The pipeline could be sized smaller to reduce the cost while still achieving some benefits of redundancy.

Project Trigger for Implementation

This project would result in redundant conveyance routes in the event of a pipeline outage. While this can be valuable in meeting existing demands during a rare outage, it is not necessary for existing demands. Customer LOS would be enhanced through implementation of the project.

Benefits Provided by Project

By providing redundancy to the existing SBWR backbone pipeline, this project benefits all retailers and customers.

Project Name: D10 - Health and Safety Facilities at Pump Stations

Estimated Cost: Less than $100,000

Project Priority: 1

Project Category: SBWR System Operations

Detailed Project Description

This project would build appropriate health and safety facilities at pump stations (e.g. a toil and sink at Pump Station 5).

Project Trigger for Implementation

This project addresses a current need.

Benefits Provided by Project

This provides basic level of health and safety facilities for operations and maintenance staff at remote pump stations.

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Appendix 4C - Zone 1 Storage Siting Study

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Appendix 4C Zone 1 Storage Siting Study

Technical Memorandum

Title: **Zone 1 Storage Siting Study**
Version: **Draft**
Prepared by: **Marc Nakamoto, RMC**
Jennifer Chang, RMC
Marilyn Bailey, RMC
Reviewed by:
Date: **December 3, 2014**
Reference: **Service Order 3**
Task 3.1.1

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Executive Summary

Zone 1 Storage is a near-term (2 to 5 year) recommended project to increase peak hour capacity, increase Zone 1 reliability, and provide greater operability and maintainability. This Siting Study evaluates alternatives for Zone 1 storage and recommends the Yerba Buena Alternative as the near-term 6 MG storage project. While not the lowest capital cost, the alternative was selected because it has the highest value based on benefits provided to the system and has the lowest net present value when

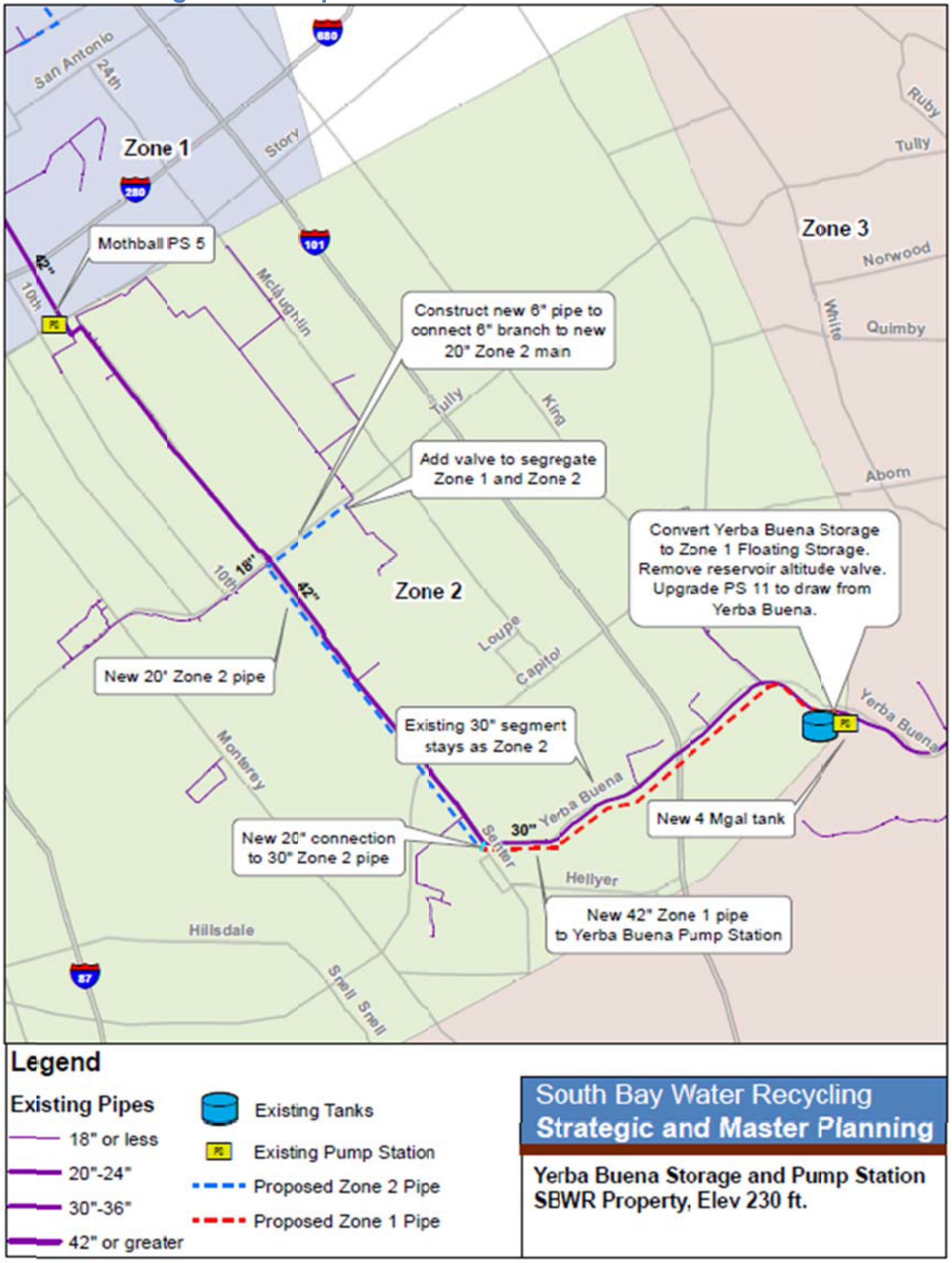
While the Yerba Buena Alternative is the recommended near-term storage location, it does not preclude other storage projects from moving forward should an opportunity arise. With a longer-term objective of 11 MG of storage, Rabello is a good option for additional storage to enhance reliability close to significant demands in the City of Santa Clara. Storage at other locations such as Mabury Station and/or

ES-1 Recommended Yerba Buena Alternative

Figure ES-1 and ES-2 show the pipeline alignments and Yerba Buena storage tank to be added. The Yerba Buena Alternative is comprised of the following major elements:

- Zone 1 pipe: 11,800 of 42 inch pipeline from Senter Road/Sylvandale Ave. to the Yerba Buena reservoir site (See Figure 3-8). The pipeline is needed to deliver water directly to Yerba Buena Reservoir while minimizing discharge pressure at TPS (minimize headloss).
- Zone 2 pipe: 9,600 ft of 18 inch pipeline in Senter Road from Sylvandale Ave. to Tully Road., 2,700 ft of 10 inch pipeline in Tully Road to connect to 6"main (See Figure 3-8)
- Pump Station 5 Bypass Pipeline Improvement
- Pump Station 8 would continue to serve Zone 2 demands (PS8 is connected to the existing 30-inch Zone 2 pipeline and would feed the Zone 2 pipe back toward Tully Road). Alternatively, PS8 could be retired and Zone 2 could be served from Zone 3 via a pressure reducing valve.
- New Pump Station 11 that draws directly from Yerba Buena and pumps directly to Zone 3

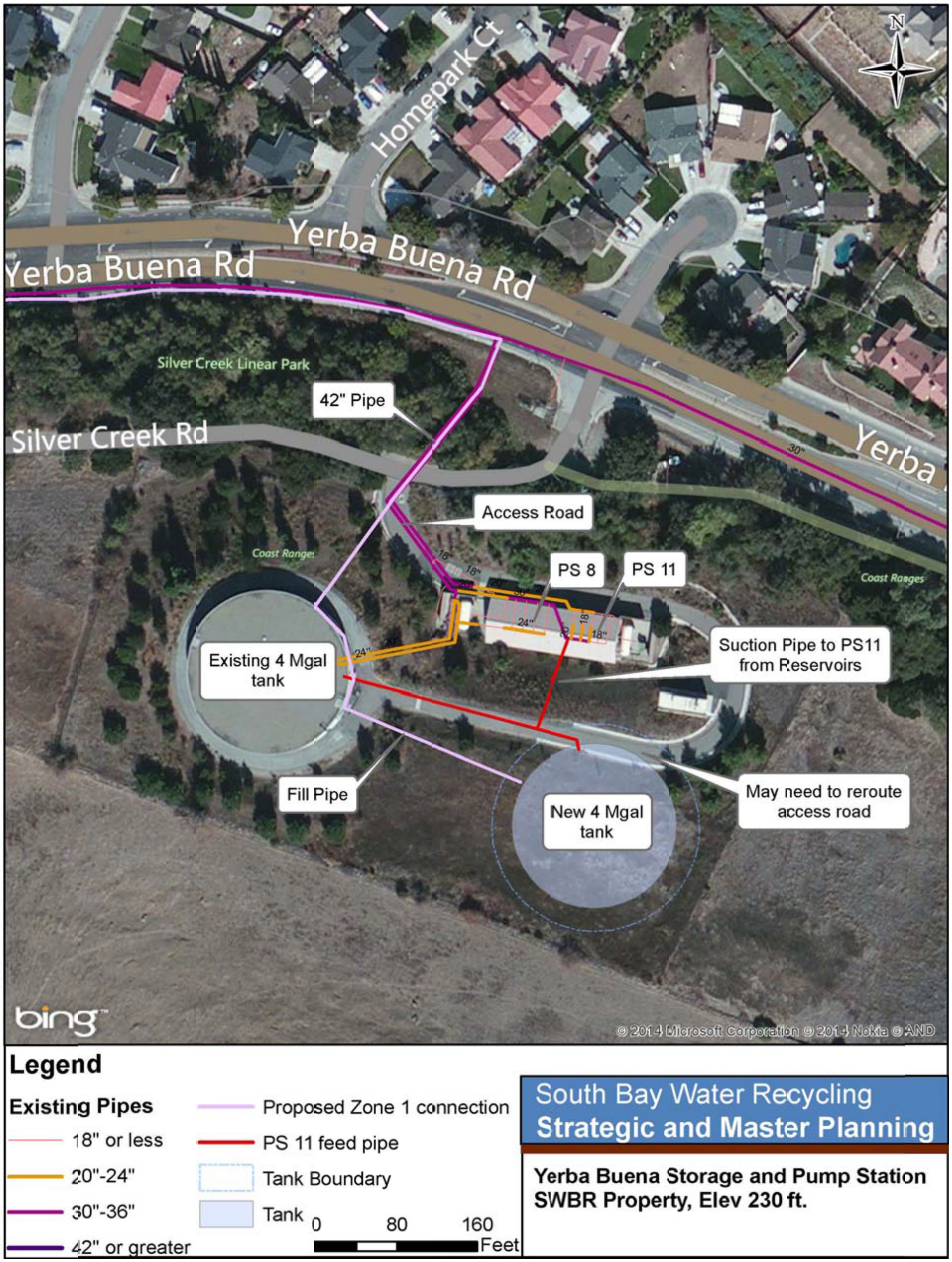
Figure ES-1: Pipeline Additions and Zone 2 Modification[a]


San Antonio
24th
Zone 1
Story
280
680
101
Zone 3
Ruby
Tully
Norwood
White
Quimby
Mothball PS 5
42"
10th
McLaughlin
Construct new 6" pipe to connect 6" branch to new 20" Zone 2 main
Tully
King
Abom
Add valve to segregate Zone 1 and Zone 2
Convert Yerba Buena Storage to Zone 1 Floating Storage. Remove reservoir altitude valve. Upgrade PS 11 to draw from Yerba Buena.
18"
10th
42"
Zone 2
Loupe
Capitol
New 20" Zone 2 pipe
Yerba Buena
Existing 30" segment stays as Zone 2
Monterey
Yerba Buena
30"
New 4 Mgal tank
New 20" connection to 30" Zone 2 pipe
Senter
Hellyer
New 42" Zone 1 pipe to Yerba Buena Pump Station
Hillsdale
87
Snell
Snell
Legend
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
Proposed Zone 2 Pipe
Proposed Zone 1 Pipe
South Bay Water Recycling
Strategic and Master Planning
Yerba Buena Storage and Pump Station
SBWR Property, Elev 230 ft.

Notes:

a. These pipeline improvements represent one alternative for maintaining existing Zone 2 pressure to existing customers. Other alternatives such as small onsite pump stations owned by customers should be

Figure ES-2: Overview of Yerba Buena Site



Benefits of the Yerba Buena Alternative include:

- Simplest operation (Alternative with lowest number of pump stations)
- Best Zone 1 hydraulics (elevated storage)
- Reduction of O&M and reduction asset replacement cost at PS 5. Potential PS5 property sales value.
- Consolidation of new storage into existing Yerba Buena site. Does not add additional site(s) that will need to be operated and maintained
- SBWR owned property (No land lease which may be required with other sites)
- Based on hydraulic modeling, storage located further south from TPS alleviates the peak hour flows that would need to be conveyed in the 42-inch Senter Road transmission line which helps

The Yerba Buena Reservoir, Pump Station 5 Retirement project could be phased to spread out capital expenditures and meet cash flow requirements. A potential phased approach includes:

- Phase 1: 42-inch Zone 1 Pipeline, 18-inch Zone 2 Pipeline, PS 5 Bypass Connection
- Phase 2: Additional 4 MG Storage
- Phase 3: New PS 11 (in conjunction with SCVWD 5 mgd demand in Zone 3)

Table ES-1 summarizes the estimated capital cost for each phase. Phase 1 provides immediate hydraulic and operational benefits as the existing 4 MG Yerba Buena Reservoir provides elevated storage for Zone 1. During peak demand periods, approximately 2.25 MG of the existing Yerba Buena tank is available for Zone 1. Phase 1 potential cost saving ideas including providing irrigation pump stations for Zone 2

The Phase 2 4 MG storage tank can be implemented as funding becomes available. The timing for Phase 2 is a function of demand increases and to what extent a moderate level of service reliability is desired. Storage volume provides more time for both planned and unplanned shutdowns without service interruption to customers. Assuming a shutdown of TPS, 6 MG of storage for Zone 1 would provide a

The Phase 3 New PS 11 would be needed in conjunction with an additional SCVWD 5 mgd in Zone 3. The existing PS 8 and PS11 arrangement with Zone 3 reservoirs has adequate capacity for existing demands.

Table ES-1: Recommended Phased Implementation Capital Cost Estimate

Element	Phase 1: 42-inch, 18-inch, PS 5 Bypass	Phase 2: 4 MG Storage	Phase 3: New PS 11
Construction Cost	**$14,600,000**	**$5,400,000**	**$7,800,000**
Implementation Cost (30%)	$4,400,000	$1,600,000	$2,300,000
Project Contingency (10%)	$1,900,000	$700,000	$1,000,000
Total Capital Budget	**$20,900,000**	**$7,700,000**	**$11,100,000**

Implementation steps for the Zone 1 storage Project include:

- Predesign
- Finance Planning and Scheduling
- CEQA Compliance
- Design
- Permitting
- Bid and Award

Development of a financing plan and strategy will be a key task that dictates the schedule for the project. Based on initial discussions with City staff, project financing may not be a viable option due to planned borrowing for the Regional Wastewater Facility upgrades. If this is the case, the project would be on a “pay as you go” approach which would require developing a capital reserve fund that could be used to pay for the project. A “pay as you go” approach would push the project schedule out as capital

Grant funding for recycled water projects is available through the following programs:

- Reclamation WaterSMART program which provides up to 25% reimbursement of project cost
- PG&E energy conservation programs
- Proposition 84 funding
- Proposition 1 Recycled Water funding

Securing of grant funds would allow the project to move forward on a faster schedule than a pay as you go approach.

1. Introduction

The San José/Santa Clara (SJ/SC) Regional Wastewater Facility (RWF), in partnership with the Santa Clara Valley Water District (SCVWD), is preparing Strategic and Master Planning (Strategic Plan or Plan) documents for the South Bay Water Recycling (SBWR) system. The Strategic Plan identified Zone 1 storage as needed to meet near-term demands, provide reliability, and meet operations objectives and

This Technical Memorandum (TM) documents the evaluation of Zone 1 storage opportunities for the SBWR system. The purpose of the Siting Study is to evaluate four storage site locations and identify a recommended Zone 1 storage site. The Siting Study identifies pipeline routing to each candidate site, describes potential non-potable reuse (NPR) customers identified in previous studies along the pipeline route, defines storage volume and pumping requirements (if applicable), hydraulic modeling, and compares the sites relative to reliability, capacity benefits, and environmental constraints. This TM

1.1 Background

The Non-Potable CIP identified the near-term NPR demands based on planning information from the six water retailers serving the SJ/SC RWF service area, i.e. the City of Milpitas, the City of Santa Clara, the City of San José Municipal Water System (San José Muni), San José Water Company (SJWC), California Water Service and Great Oaks Water Company. Of these six retailers, four – the City of Milpitas, the City of Santa Clara, San José Muni and SJWC – have plans to expand recycled water use. In addition, the Silver Creek Pipeline Agreement (2002) between the City of San José and the Santa Clara Valley Water District (SCVWD) reserves 5 mgd (5,600 AFY) of SBWR capacity for SCVWD use. SCVWD's 5 mgd of reserved capacity is currently envisioned to be used for potable reuse. However, SCVWD's 5 mgd commitment is treated as an NPR demand since the water would be conveyed through the SBWR

Storage Analysis

Table 1-1 summarizes the existing and projected demands by zone and the target storage volume needed in each zone. A recommended target storage volume of 50 percent maximum day demands was established to provide increased reliability and operational flexibility. The target storage needed is considered a long-term goal and was not economically feasible in the near-term. Therefore, an

The primary function of Zone 1 storage is to provide diurnal peak demand shaving and increase the peak capacity of the system to serve customers commitments. Figure 1-1 shows the existing and projected Zone 1 diurnal patterns. Ideally, Zone 1 storage would allow the TPS to pump at a relatively constant and when demand rises above the daily demand the tank would provide the additional supply to the system.

Table 1-1: Demand By Zone, Existing Storage, and Target Storage

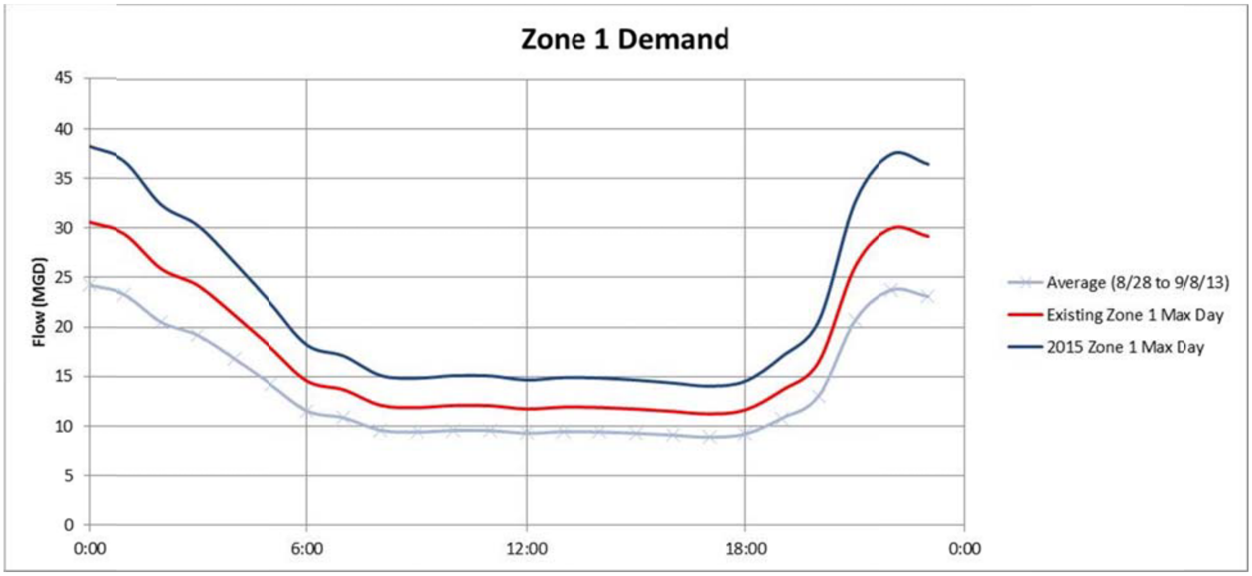
	Existing Max Day (mgd)	Near-term Max Day (mgd)	Near-term w/SCVWD Max Day (mgd)	Existing Storage (MG)	Target Storage (MG)	Target minus Existing Storage (MG)
Zone 1	17.6	22.0	22.0	0	6.0[b]	6.0
Zone 2	1.9	2.5	2.5	4	1.75[a]	-2.25
Zone 3	5.1	5.1	10.1	5.5	5.0[a]	-0.5
Villages	0.7	0.7	0.7	0	0.35	0.35

Footnotes:

a. Target storage for Zones 2 and 3 is based on 50% of "Near-term with SCVWD Max Day" demand.

b. For Zone 1, the 50% max day demand storage criterion equates to 11 MG of storage which would entail a significant capital expenditure. Given the limitations on capital funding, the SBWR system hydraulic model was used to evaluate system performance with storage volume less than the 11 MG identified. Modeling indicated that 6 MG of Zone 1 storage was adequate to stabilize the system. The Zone 1 recommended volume of 11 MG remains a long term

Figure 1-1: Zone 1 Existing and Projected Max Day Demands



Notes:

1. This figure shows the demand for Zone 1 customers and does not include pass through flow for other Zones.

Design Criteria (Concept Level)

Table 1-2 summarizes the conceptual level design criteria for the proposed storage and pump station facilities based on the existing SBWR Zone 1 diurnal pattern, pump station layout assumptions,

Table 1-2: Zone 1 Storage Flow Design Criteria

Criteria	Requirement
Zone 1 Max day demand	22.0 mgd
Zone 1 Peak hour demand	38.2 mgd
Desired Peak Hour Flow from 6 MG storage	16.2 mgd
Pump Station Layout	2 duty, 1 standby
Zone 1 gradeline	250 ft
Assumed pump efficiency (vertical turbine pumps/split case pumps)	80%/70%

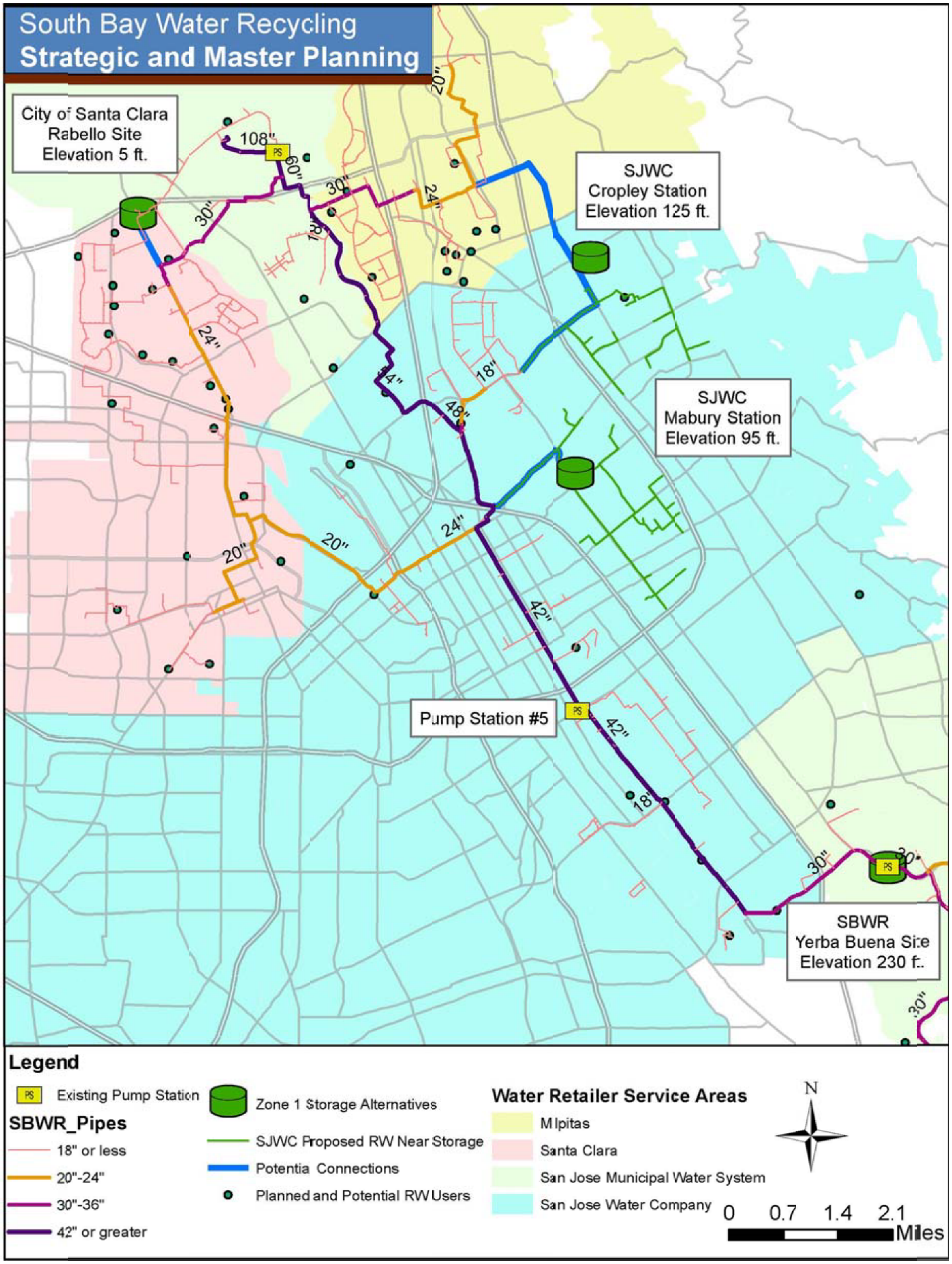
Storage Project Partnerships

SBWR staff has met with the City of Santa Clara and SJWC to identify potential sites for storage within or near Zone 1. SBWR staff also met with staff from the City of Milpitas but did not identify any available sites. Partnering with a retailer provides mutual benefits and eliminates the need for property acquisition. In total, three potential, retailer-owned sites were chosen as potential Zone 1 storage sites. The three potential sites identified by City of Santa Clara and SJWC and evaluated in this TM are listed

- Cropley Station (land owned by San José Water Company)
- Mabury Station (land owned by San José Water Company)
- Rabello Pump Station (land owned by City of Santa Clara)

The Cropley Station, Mabury Station, and Rabello Pump Station sites are non-elevated storage sites meaning they would require adjoining pump stations to deliver stored water back to the system. The Yerba Buena site is an elevated storage in which the reservoir elevation matches the Zone 1 hydraulic grade line elevation. Elevated storage tanks do not require an adjoining pump station for the Zone

Figure 1-2: Potential Zone 1 Storage Sites



1.2 TM Organization

This TM is organized into three main sections:

- Comparison of Steel vs. Pre-stressed Concrete Tanks
- Investigation of each proposed storage site
- Comparison of proposed storage sites to determine recommended site

An Environmental Constraints Analysis of the proposed sites is included as a separate Appendix in the Strategic Plan Report.

2. Comparison of Steel vs. Pre-stressed Concrete Tank

Welded steel tanks and pre-stressed concrete tanks are viable options for above grade storage. For buried or partially buried storage pre-stressed concrete tank would be recommended. Cast in place concrete tanks are also an option that may be advantageous for sites with dimensions that are conducive to a rectangular tank. The following sections below provide a brief overview of the circular weld steel tanks and pre-stressed concrete tanks. Cast in place tanks have not been considered at this

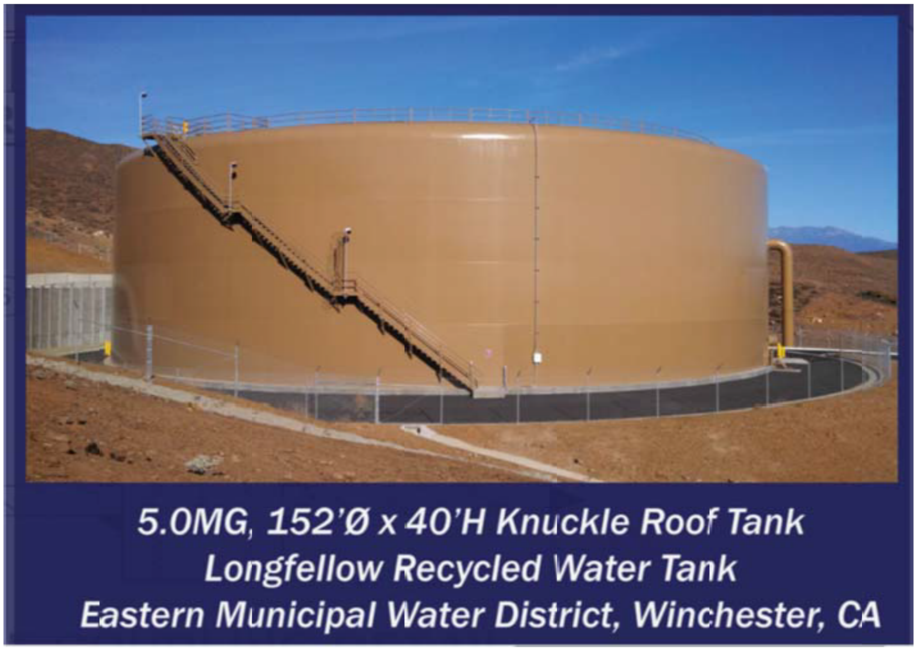
Table 2-1: Steel Tank and Pre-stressed Concrete Tank Comparison Summary

Comparison Item	Steel Tank	Pre-stressed Concrete
Inspection	Every 2 to 3 years.	Every 10 to 15 years. Every 5 years after age 20.
Maintenance	Recoat tank every 15 years	Address concrete age issues every 25 to 30 years
Raw Construction Cost 3 MG	$2.1 M	$2.5 M
Buried or Partially Buried	No	Yes

2.1 Welded Steel Tanks

Welded steel tanks (Figure 2-1) are a time tested storage technology used throughout the region by municipalities and water supplier for water storage. Generally, steel tanks have a lower capital cost than concrete tanks but have higher maintenance associated with recoating and corrosion monitoring

Figure 2-1: Welded Steel Tank Example



5.0MG, 152'Ø x 40'H Knuckle Roof Tank
Longfellow Recycled Water Tank
Eastern Municipal Water District, Winchester, CA

Table 2-2 summarizes typical dimensions and standard steel tank costs provided by Paso Robles Tank. The estimated cost represents raw tank construction costs and do not include site development, special foundation requirements, or piping.

Table 2-2: Steel Tank Sizing Characteristics and Estimated Tank Costs

Capacity	Suggested Diamete (ft)	Suggested Side Water Depth (ft)	Freeboard (ft)	Estimated Cost
2.5 MG	112	29	3	$1.7M
3.0 MG	118	37	3	$2.1M
3.5 MG	128	37	3	$2.5M
4.0 MG	137	37	3	$2.9M
4.5 MG	145	37	3	$3.2M
5.0 MG	152	37	3	$3.5M

Notes:

1. Estimated raw construction costs were provided by Paso Robles Tank on September 19, 2014 and include at standard foundation, steel tank, and tank coating.

2. Suggested diameter and side water depth provided by Paso Robles Tank on September 19, 2014. Manufacturer noted that diameter and height can be adjusted for site requirements.

Maintenance Requirements

Welded steel tanks need to be recoated periodically. The tank coating should be checked and inspected once every two to three years by draining the tank. For maintenance estimating purposes, it is assumed

2.2 Pre-stressed Concrete Tanks

Pre-stressed concrete tanks generally have lower inspection and maintenance costs but a higher capital cost than steel tanks. The SBWR Yerba Buena and Zone 3 tanks are pre-stressed concrete tanks. In comparison to welded steel tanks, the advantages of pre-stressed concrete tanks are as follows:

- Enhanced insulation properties assist in keeping water at a cooler and more consistent temperature reducing microbial growth potential
- Reduced frequency for inspection and maintenance compared to steel tanks

Figure 2-2: Pre-stressed Concrete Tank Example

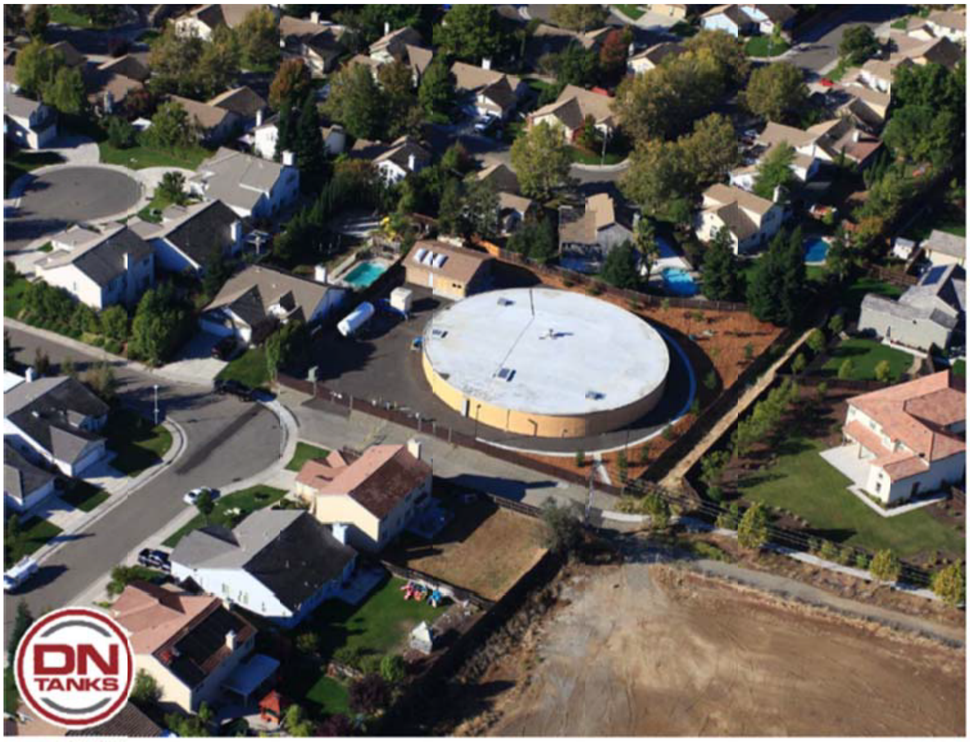


Table 2-3 summarizes typical dimensions and standard pre-stressed concrete tank budgetary costs provided by DN Tanks. The budget estimate assumes a standard spread footing, 6” membrane slab, concrete roof, hatch and vent. The estimate does not include costs for site work, appurtenances, piping, special foundation requirements, or exterior aesthetics coatings.

Table 2-3: Pre-stressed Concrete Tank Sizing Characteristics

Capacity	Suggested Diameter (ft)	Suggested Side Water Depth (ft)	Freeboard (ft)	Estimated Cost
2.5 MG	120 – 156	30 - 18	2 - 5	$2.1M to $2.4M
3.0 MG	132 – 171	30 - 18	2 - 5	$2.3M to $2.7M
3.5 MG	142 – 175	30 - 20	3 - 4	$2.5M to $2.9M
4.0 MG	152 – 187	31 - 20	3 - 4	$2.8M to $3.2M
4.5 MG	154 – 189	33 - 22	3 - 4	$2.9M to $3.3M
5.0 MG	162 – 199	34 - 22	3 - 4	$3.1M to $3.6M

Maintenance Requirements

Inspection and maintenance effort is minimal for concrete tanks. Cracks and deterioration may occur with age and concrete rehabilitation may be necessary at 25 to 30 years of age.

2.3 Cost Basis for Storage Study

The cost estimates supplied from the tank fabricators above are for straightforward tank installations and have unit costs of less than $1 per gal. For the alternatives evaluation, a unit cost for $1.0 per gallon was used for alternative cost comparison and tanks were assumed to be pre-stressed concrete tanks

3. Storage Sites Alternatives

The following sections provide a summary of the four sites under consideration for storage. The Cropley Station and Mabury Station are significant sites with the potential to accommodate 6+ MG of storage in above grade circular tanks. The Rabello Pump Station site has a smaller area with a potential for 2 to 3 MG in an above grade circular tank arrangement. The Yerba Buena site contains an existing 4 MG

To provide an initial comparative cost evaluation of each site and recognizing the 3 MG estimated size limit for the Rabello site, each site was evaluated assuming a 3 MG pre-stressed concrete storage tank and an 8 mgd pump station. Note that the Yerba Buena site is a unique alternative due to the existing

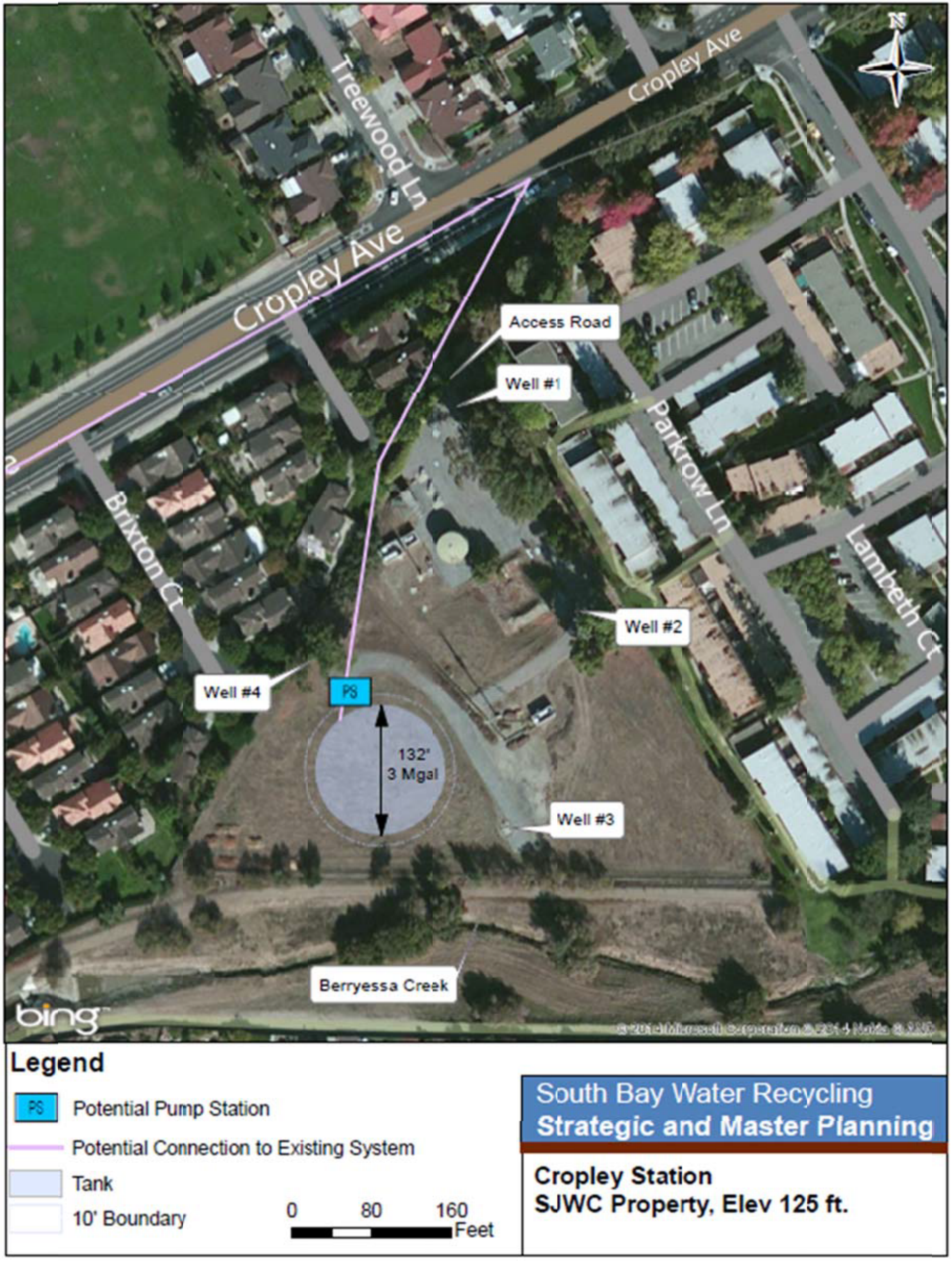
To meet the total storage target of 6 MG, pairs of 3 MG tanks are then evaluated for Cropley Station, Mabury Station, and Rabello. A 6 MG Mabury Station alternative cost estimate was also developed for comparison purposes. An increase in tank size from 3 MG to 6 MG at Mabury also requires an increase in pump station capacity and infrastructure/pipe size to accommodate higher flow rates.

3.1 Site 1 – Cropley Station

Background/Data Collection

The Cropley Station site is owned by San José Water Company (SJWC) and includes groundwater well and booster pump station facilities that are currently only used for emergency purposes. The site is located on Cropley Avenue near Treewood Lane in San José, California. The southern edge of the site is separated by a fence from Berryessa Creek and an easement with the Santa Clara Valley Water District. Figure 3-1 shows the site and a potential 132 ft diameter tank that could be sited to minimize the impact

Figure 3-1: Overview of Cropley Station


N
Cropley Ave
Cropley Ave
Treewood Ln
Brixton Ct
Parkrow Ln
Lambeth Ct
Access Road
Well #1
Well #2
Well #3
Well #4
PS
132'
3 Mgal
Berryessa Creek
bing
© 2014 Microsoft Corporation © 2014 Nokia © AND
Legend
PS Potential Pump Station
Potential Connection to Existing System
Tank
10' Boundary
0
80
160
Feet
South Bay Water Recycling
Strategic and Master Planning
Cropley Station
SJWC Property, Elev 125 ft.

Notes:

1. Cropley Station site could accommodate 6+ MG of storage in above grade circular tank(s).

Existing Major Infrastructure

Cropley Station has four existing groundwater wells that are scheduled for retirement. Only one well is currently operating, the remaining three wells have been taken out of service due to manganese issues. As a result of the wells being scheduled for retirement, any part of the Cropley Station site is available for Zone 1 storage. In addition to the four wells, the following infrastructure currently exists at Cropley

- Three booster pumps (125 hp, 100 hp, 150 hp), one pump used as inter-zone booster
- Sand separators
- Steel tank (29’-8” diameter x 16’-1” height, 83,454 gal capacity, base elev. 138.3’)
- PG&E service (main breaker: 1000A – 480V 3P-4W)
- Piping and instrumentation in site and along access road

Cropley Station is at an elevation of 125 feet, the highest elevation of the three non-elevated sites under consideration, and recycled water stored onsite would need to be pumped to the Zone 1 gradeline which is at elevation 250 feet. The nearest pipes in the SBWR system to Cropley Station are a 20 inch diameter pipe in Milpitas on Yosemite Drive and an 18 inch diameter pipe in San José on Hostetter Road. SJWC has plans to extend the Hostetter Road recycled water pipeline to the eastside of I680 which

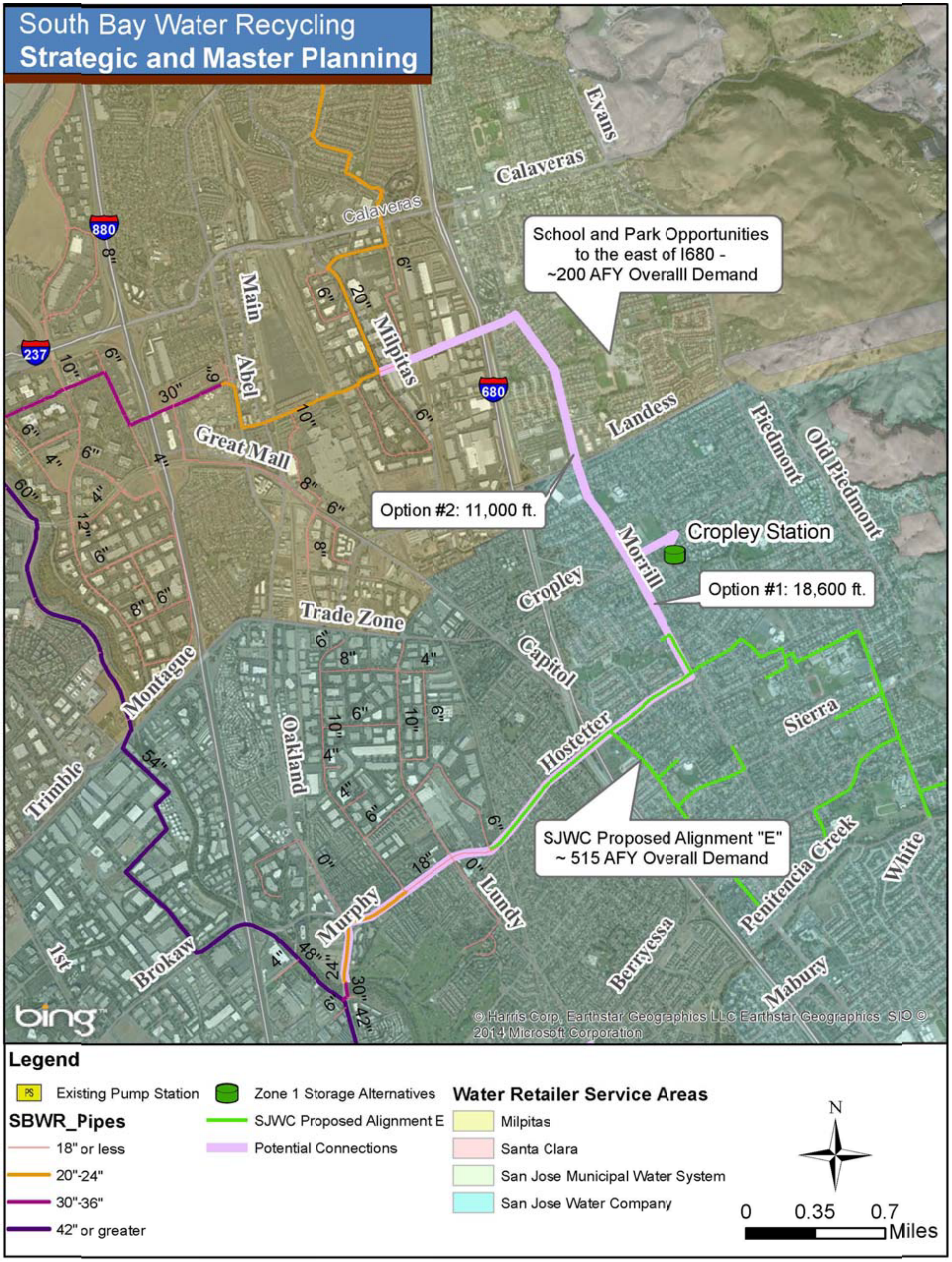
Table 3-1: Cropley Station Characteristics

Characteristic	Value
Distance to Existing Transmission Line	Milpitas Option: 11,000 LF San José Option: 12,250 LF (8,200 ft of pipe is along SJWC future recycled water service pipeline)
Nearest Transmission Main Size	Milpitas Option: 20 inch diameter San José Option: 18 inch diameter
Site Elevation	125 ft

Potential New Non-Potable Reuse

There are several potential non-potable reuse opportunities near the Cropley Station site. In San José, proposed alignment “E” is planned to the east of Cropley Station and is expected to service 515 acre feet per year of non-potable reuse demand. Opportunities for non-potable reuse exist in Milpitas along the proposed connection point from the Cropley Station storage tank to the 20-inch transmission line. Reuse opportunities included Blue Sky Research, Citation-Piper cul-de-sac, Trumark Residential, Taylor-Morrison District 2, Seagate, Milpitas Station, and Milpitas Transit Center. In addition, approximately

Figure 3-2: Proposed Connections from Cropley Station to existing SBWR System



Environmental Constraints[1]

Cropley Station is an existing water utility parcel and construction of a storage tank would be consistent with current use and not divide existing land uses. Construction-related traffic, noise, and air pollution for Cropley Station alternative would be the greatest of the three potential non-elevated sites evaluated due to the length of its proposed connection to the existing SBWR system (~4.4 miles). Elevated berms next to Berryessa Creek appear sufficient to prevent runoff of construction storm water discharge. Nine

alignment. The potential to encounter soil and/or groundwater contamination during pipeline excavation is low to moderate. For any alternative, it would be advisable to prepare a health and safety plan and a contingency plan to provide for protocols in the event unanticipated hazardous materials are encountered during construction.

The Cropley Station alternative would have no impact on historic architectural resources, a low potential to encounter unanticipated historic-era archaeological resources or paleontological resources, and a moderate potential to encounter unanticipated prehistoric archaeological resources.

The project site is a primarily developed water utility yard with scant biological resources onsite. While a nesting bird survey is recommended due to the adjacent drainage feature, no other biological constraints are anticipated at Cropley Station.

The site is not located within any fault or landslide zones. Portions of the pipeline are located within a liquefaction zone.

Pumping/Hydraulic Modeling

The Cropley Station site is located on the east side of I680 and has several alternatives for connecting to SBWR transmission mains. Option 1 is a pipeline to Hostetter Road to cross under I680 and tie into the 42-inch transmission main at Oakland Road and Schallenberger. For Option 1, the storage tank and pump station generally help to meet demands south of the connection point to the 42-inch pipeline. Option 2 is a pipeline that goes north toward the City of Milpitas system and ties into the 20-inch line at Milpitas Blvd. and Yosemite Drive. For Option 2, the storage tank and pump station generally help to

Table 3-2 summarizes the conceptual pump station design criteria associated with a 3 MG storage tank. In general, the storage tank would be filled during low demand periods of the day and the pump station would deliver water back to the system during high demand periods. From a hydraulic stand point, the Cropley flow addition to the 42-inch transmission main prior to the major flow split at Hedding creates a

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[1] Provided by Environmental Science Associates, October 31, 2014, as part of SBWR Zone 1 Storage Siting Study Environmental Constraints Analysis. The full Environmental Constraints Analysis is included as a separate Appendix in the Strategic Plan Report.

Compared to other storage alternatives, it is more difficult to get water from the Cropley tank into the main system due to the distance from the main transmission line and the tie in location to the main transmission line which is not idea from the hydraulics standpoint.

Table 3-2: Cropley Pump Station Design Criteria

Criteria	Units	Value
Total Design Flow Rate	gpm	5,500
No. of Pumps	-	2 Duty + 1 standby
Design Flow rate per pump	gpm	3,125
TDH	ft	170
Pump hp, each	hp	200
Total hp	hp	600

Notes:

1. Pump station flow rate assumes 3 MG storage tank. Implementation of a larger tank would increase the design flow rate of the pump station.

Construction Considerations

Nearby housing developments should be considered during construction. There may be concerns from neighbors regarding tank height and disturbances caused by construction and equipment. Access to the site is by a short access road off Cropley Avenue. The dimensions of any large equipment or materials should be compared with the road width prior to start of construction. Construction should be mindful

Operations and Maintenance Estimates

A storage tank and pump station at the Cropley Station site would increase operations and maintenance for the system. Operations would need to integrate and coordinate the operation of the pump station and tank into existing operation. This would entail making decisions on how to operate the pump station through variations in demand and altering the fill cycle through different seasons. Operators and maintenance personnel would need to periodically visiting the site for equipment checks, maintenance,

Mechanical, electrical, and instrumentation equipment will need to be replaced periodically. For cost estimating purposes, annual consumable costs are assumed to be 2% per year for mechanical, electrical, and instrumentation equipment.

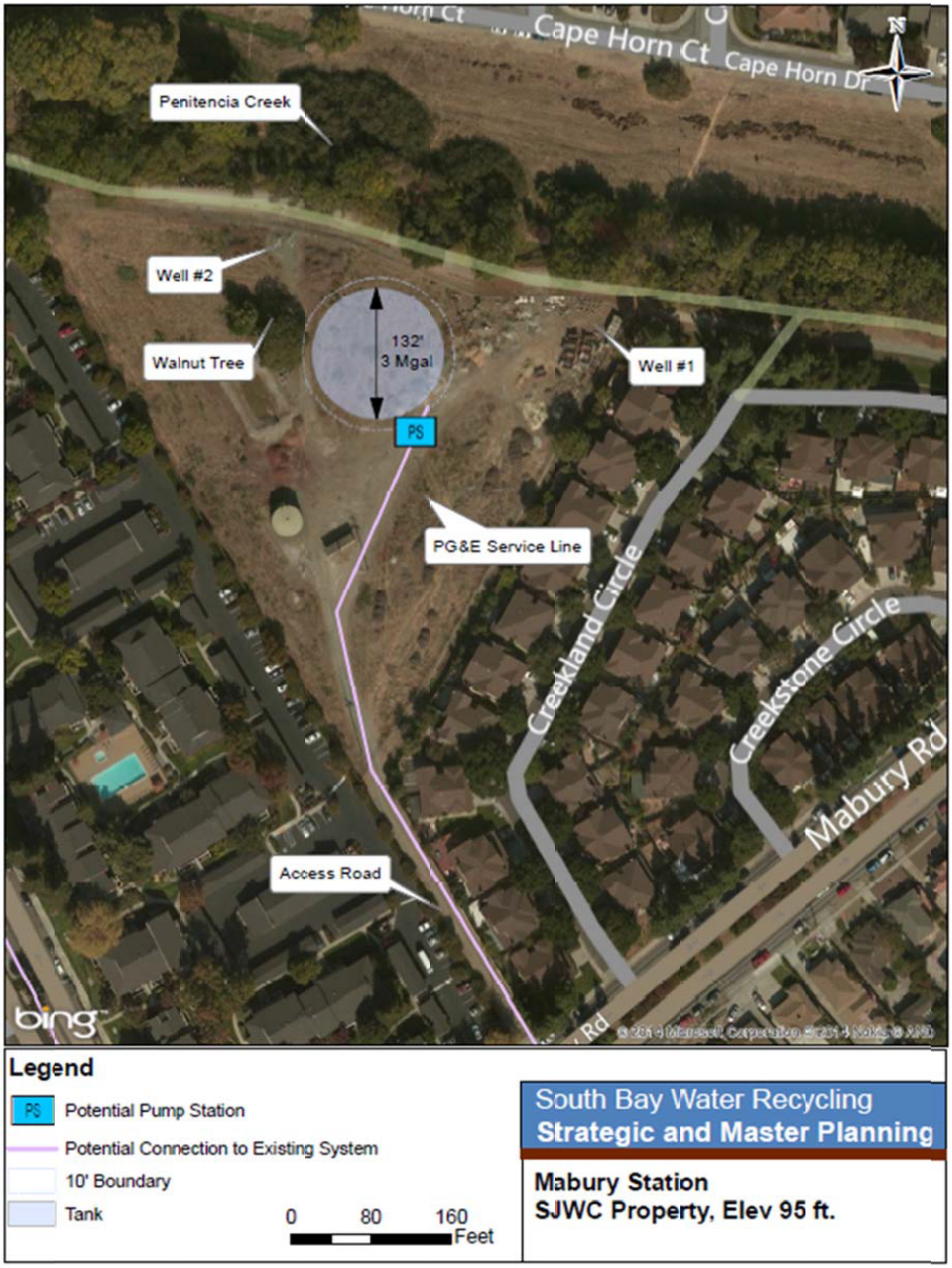
Pumping station energy costs was estimated assuming 2,700 AFY pass through the storage tank and pump station. This was estimated as 17% of the average Zone 1 demand.

3.2 Site 2 – Mabury Station

Background/Data Collection

The Mabury Station site is owned and operated by SJWC and includes groundwater pumping facilities that are used rarely. The site is located off of Mabury Road near North King Road in San José, California. The northern edge of the triangular site abuts Penitencia Creek and residential development borders the site on the eastern and western edges. An access road connects the southern point of the site to Mabury Road. Figure 3-3 shows the site and a potential 132 ft diameter tank that could be sited to

Figure 3-3: Overview of Mabury Station



Notes:

1. Mabury Station site could accommodate 6+ MG of storage in above grade circular tank(s).

Existing Major Infrastructure

Mabury Station has two existing groundwater wells that are rarely used but should be avoided. SJWC plans to maintain the wells and these portions of the site are not available for Zone 1 storage. Pipelines associated with the wells can be relocated as necessary to avoid tank footprint. In addition to the two

- Booster pump (40 hp)
- Sand separators
- Steel tank (29'-8" diameter x 16'-1" height, 83,454 gal capacity, base elev. 138.3')
- PG&E service (main breaker: 1600A – 480V 3P-3W)
- Piping and instrumentation site in and along access route

Mabury Station has an elevation of 95 feet and recycled water stored onsite would need to be pumped to the Zone 1 gradeline. Figure 3-4 shows the nearest SBWR transmission pipe is 42 inches in diameter at the intersection of Mabury Road and Berryessa Road near Highway 101

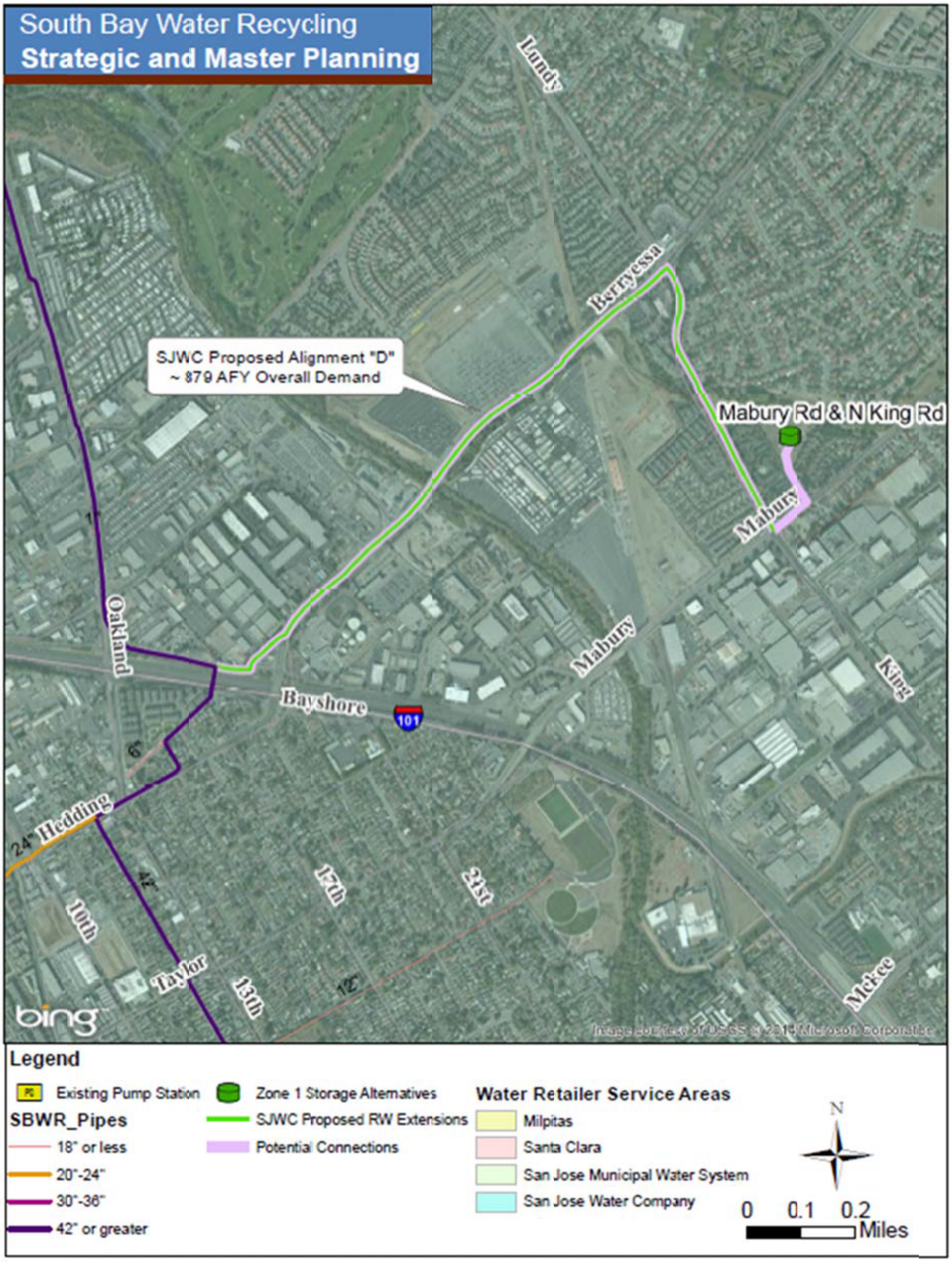
Table 3-3: Mabury Station Characteristics

Characteristic	Value
Distance to Existing Transmission Line	10,000 LF to transmission main
Nearest Transmission Main Size	42 inch diameter
Elevation	95 ft

Nearby Non-Potable Reuse

The route to Mabury Station site follows a planned SJWC alignment D and provides an opportunity to cost share on the pipeline costs. Alignment D has an associated total demand of 879 acre feet per year

Figure 3-4 Proposed Connection from Mabury Station to existing SBWR System



Environmental Constraints[2]

Mabury Station is an existing water utility parcel and construction of a storage tank would be consistent with current use and not divide existing land uses. Construction-related traffic, noise, and air pollution for Mabury Station would less than for Cropley Station. Elevated berms next to Penitencia Creek appear sufficient to prevent runoff of construction storm water discharge. Ten closed LUST sites and four open remediation sites are located along the pipe alignment. Due to the size and nature of the industrial facilities near the southern end of Berryessa Road near the Bayshore Freeway, the potential to encounter soil and/or groundwater contamination is moderate to high. For any alternative, it would be

The Mabury Station alternative would have no impact on historic architectural resources, a low potential to encounter unanticipated historic-era archaeological resources or paleontological resources, and a moderate potential to encounter unanticipated prehistoric archaeological resources

The project site is a primarily developed water utility yard with scant biological resources onsite. Removal of California black walnut trees located in the center of the site would require a City of San José Live Tree Removal Permit, public noticing, and hearing. The trees are not listed as City of San José

The tank location and pipeline alignment are located within a potential liquefaction zone.

Pumping/Hydraulic Modeling

Table 3-2 summarizes the conceptual pump station design criteria for a 3 MG tank at the Mabury station site. In general, the storage tank would be filled during low demand periods of the day and the pump

The pipeline connection point to the main transmission line near Hedding Street is near the City of Santa Clara loop connection. Therefore, the Mabury storage tank and pump station would generally help meet peak diurnal demands on and south of Hedding Street area. With this offset, peak hour flows from TPS

Modeling also indicated the following attributes relative to other alternatives:

- Compared to Cropley Alternative, Zone 1 capacity enhancement by providing storage further south. Capability of supplies Zone 1 from two ends of Zone 1.
- Compared to Cropley Alternative, better ability to move water to Zone 2 and 3. Less flow bottleneck issues in primary transmission line.
- Compared to Cropley Alternative, easier hydraulically to get water back to Zone 1 system due to

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[2] Provided by Environmental Science Associates, October 31, 2014, as part of SBWR Zone 1 Storage Siting Study Environmental Constraints Analysis. The full Environmental Constraints Analysis is included as a separate Appendix in the Strategic Plan Report

Table 3-4: Mabury Pump Station Design Criteria

Criteria	Units	Value
Total Design Flow Rate	gpm	5,500
No. of Pumps	-	2 Duty + 1 standby
Design Flow rate per pump	gpm	3,125
TDH	ft	185
Pump hp, each	hp	200
Total hp	hp	600

Notes:

1. Pump station flow rate assumes 3 MG storage tank. Implementation of a larger tank would increase the design flow rate of the pump station

Construction Considerations

Nearby housing developments should be considered during construction. There may be concerns from neighbors regarding tank height and disturbances caused by construction and equipment. Access to the site is by a short road off Mabury Avenue. The dimensions of any large equipment or materials should be compared with the road width prior to start of construction. Construction should be mindful of

Operations and Maintenance Estimates

A storage tank and pump station at the Mabury Station site would increase operations and maintenance for the system. Operations would need to integrate and coordinate the operation of the pump station and tank into existing operation. This would entail making decisions on how to operate the pump station through variations in demand and altering the fill cycle through different seasons. Operators and maintenance personnel would need to periodically visiting the site for equipment checks, maintenance,

Mechanical, electrical, and instrumentation equipment will need to be replaced periodically. For cost estimating purposes, annual consumable costs are assumed to be 2% per year for mechanical, electrical, and instrumentation equipment

Pumping station energy costs was estimated assuming 2,700 AFY pass through the storage tank and pump station. This was estimated as 17% of the average Zone 1 demand.

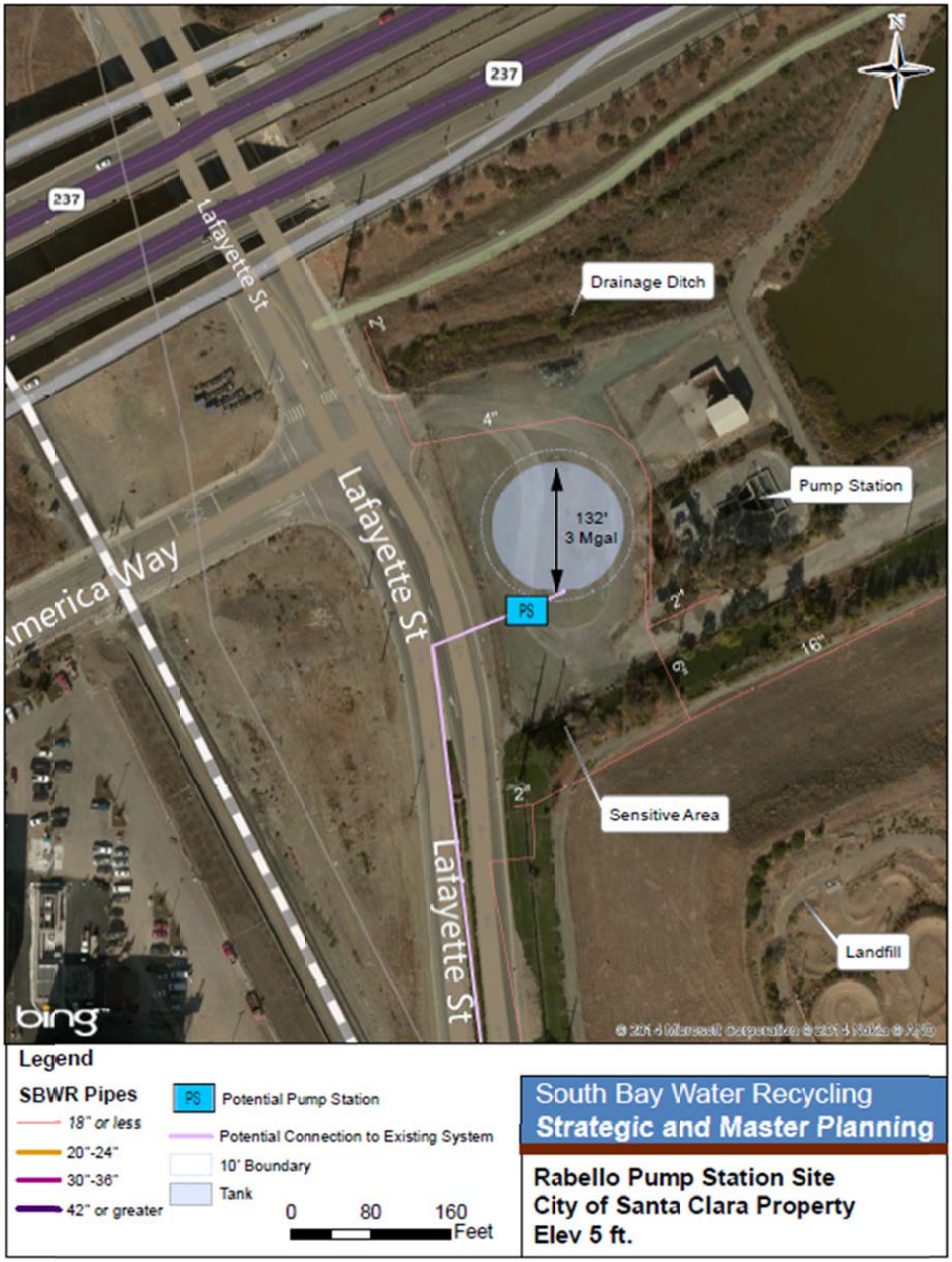
3.3 Site 3 – Rabello Pump Station

Background/Data Collection

The Rabello Pump Station (sanitary sewer pump station) site is owned by the City of Santa Clara and includes an existing sanitary sewer pump station and associated equipment. Adjacent to the pump station area is the Eastside Retention Pond. The site is located at the intersection of Lafayette Street and Great America Way near Highway 237 in Santa Clara, California. Bordered by Highway 237 to the north and a retired landfill to the south, the Rabello site does not have adjacent business or residential

site given the available north/south dimension. This would be evaluated further if Rabello is a recommended site. A rectangular concrete tank would be more costly than a circular tank.

Figure 3-5: Overview of Rabello Pump Station



Existing Major Infrastructure

The Rabello Pump Station site is the main sanitary sewer pump station owned and operated by the City of Santa Clara that conveys the City's flow to the Regional Wastewater Facility. Any new storage facility and construction on this site would need to avoid interference with existing pump station operations and infrastructure. In addition to the pump station, the following infrastructure currently exists at the

- Standby generator
- Drainage ditch feature located on the northside of the site
- Two 42" sanitary sewer mains connected to the pump station
- PG&E 24" and 36" gas lines

The Rabello Pump Station site is at an elevation of five feet, the lowest elevation of the sites under consideration. Figure 3-6 shows the location of the site relative to the nearest SBWR transmission pipe (a 30-inch diameter pipe) on Lafayette Street.

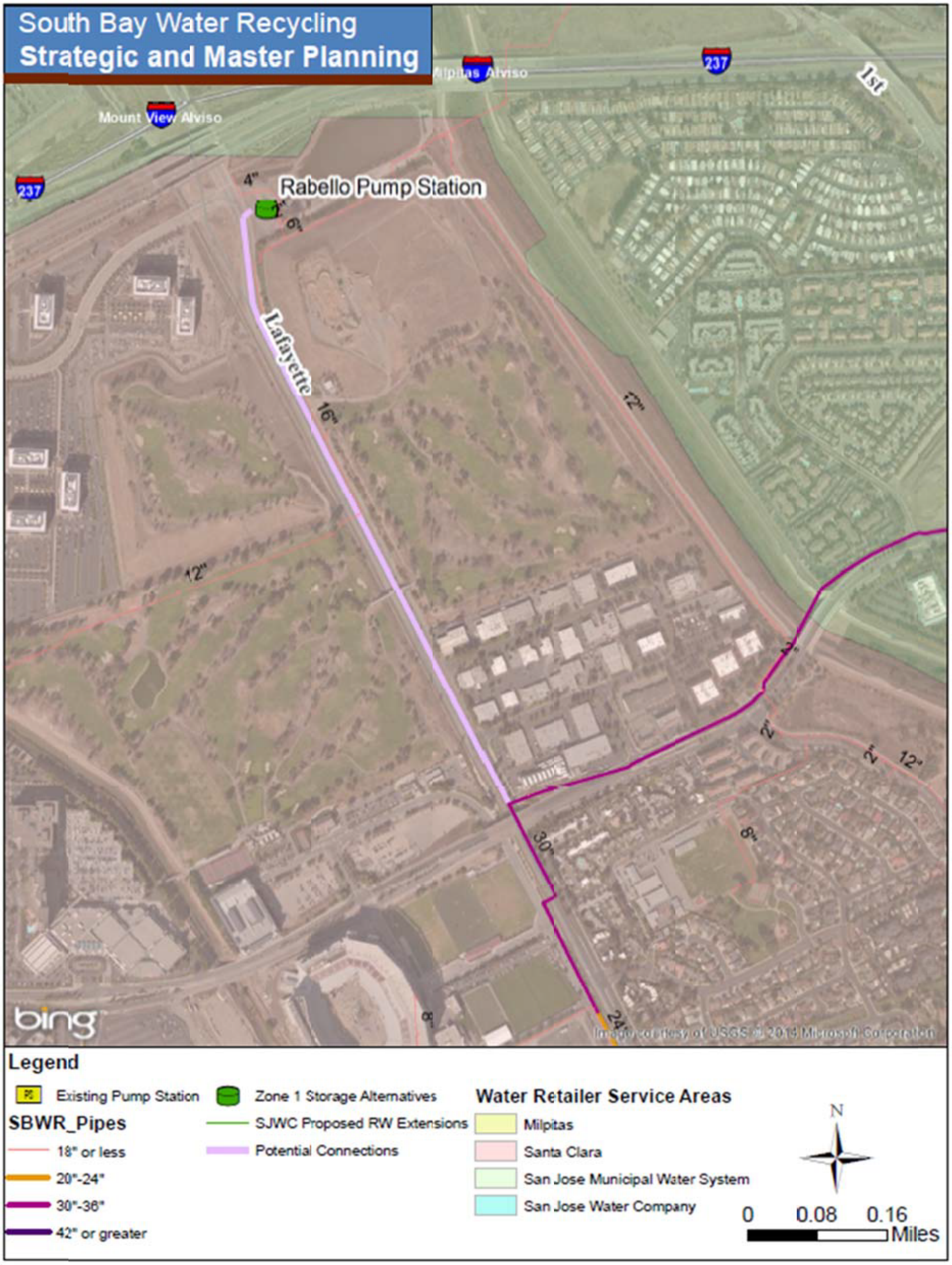
Table 3-5 Rabello Site Characteristics

Characteristic	Value
Distance to Existing Transmission Line	4,200 LF to transmission main
Nearest Transmission Main Size	30 inch diameter
Elevation	5 ft

New Non-Potable Reuse

Installation of storage at Rabello Pump Station would not facilitate new opportunities for non-potable reuse and the area already has established recycled water use.

Figure 3-6 Proposed Connection from Rabello Pump Station to existing SBWR System



Environmental Constraints[3]

Rabello Pump Station is an existing water utility parcel and construction of a storage tank would be consistent with current use and not divide existing land uses. Construction-related traffic, noise, and air pollution for Rabello Pump Station would less than for Cropley Station. During the September 22, 2014 site visit to Rabello when the site was being used as a construction staging area, construction At a minimum, such BMPs would be needed during storage tank construction. The Santa Clara All Purpose Landfill is located adjacent to the south of the project site. Groundwater in this area could be affected by leachate and by volatiles organic compounds (VOCs) that have been detected in the landfill groundwater monitoring. Routing the proposed pipeline alignment to avoid potential interface with the landfill's clay liner and leachate extraction system is recommended. For any alternative, it would be advisable to prepare a health and safety plan and a contingency plan to provide for protocols in the

The Rabello Pump Station alternative would have no impact on historic architectural resources, a low potential to encounter unanticipated historic-era archaeological resources or paleontological resources, and a moderate potential to encounter unanticipated prehistoric archaeological resources.

The project site is a primarily developed water utility yard with scant biological resources onsite. If the proposed pipeline alignment were to be routed along the fenceline at the base of the landfill, where a small, isolated patch of potential wetlands was noted, resource agency permitting could be required for

Based on available geotechnical data, the site is not located within any fault zones or earthquake induced landslide zones. The project site is located within a liquefaction zone on former marsh lands.

Pumping/Hydraulic Modeling

The Rabello site has the lowest elevation of the site under consideration with an elevation of about 5 ft. Table 3-2 summarizes the conceptual pump station design criteria associated with a 3 MG storage tank. In general, the storage tank would be filled during low demand periods of the day and the pump station

A Rabello storage tank and pump station generally helps to meet demands in the northwest portion of the system in the City of Santa Clara during peak demand periods. With this offset, peak hour flows from TPS are generally focused in the southerly direction down the primary transmission main.

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[3] Provided by Environmental Science Associates, October 31, 2014, as part of SBWR Zone 1 Storage Siting Study Environmental Constraints Analysis. The full Environmental Constraints Analysis is included as a separate Appendix in the Strategic Plan Report.

Table 3-6: Rabello Pump Station Design Criteria

Criteria	Units	Value
Total Design Flow Rate	gpm	5,500
No. of Pumps	-	2 Duty + 1 standby
Design Flow rate per pump	gpm	3,125
TDH	ft	230
Pump hp, each	hp	250
Total hp	hp	750

Notes:

1. Pump station flow rate assumes 3 MG storage tank. Implementation of a larger tank would increase the design flow rate of the pump station

Construction Considerations

The Rabello site is the smallest of the three sites and likely cannot accommodate 6 MG of volume in a circular tank. It is possible that a 6 MG rectangular cast in place concrete tank could be constructed at the site. The Rabello site has the lowest elevation of the three options and requires the largest pump station and highest energy consumption. The site is located in close proximity to the San Francisco Bay and in a zone that typically has challenging soil conditions such as bay mud and/or soil settlement. A storage tank at this site may require special foundation considerations and construction to mitigate soil

Operations and Maintenance Estimates

A storage tank and pump station at the Rabello Pump Station site would increase operations and maintenance for the system. Operations would need to integrate and coordinate the operation of the pump station and tank into existing operation. This would entail making decisions on how to operate the pump station through variations in demand and altering the fill cycle through different seasons. Operators and maintenance personnel would need to periodically visiting the site for equipment checks,

Mechanical, electrical, and instrumentation equipment will need to be replaced periodically. For cost estimating purposes, annual consumable costs are assumed to be 2% per year for mechanical, electrical, and instrumentation equipment

Pumping station energy costs was estimated assuming 2,700 AFY pass through the storage tank and pump station. This was estimated as 17% of the average Zone 1 demand.

3.4 Yerba Buena Reservoir, Pump Station 5 Retirement, and Operational Enhancement

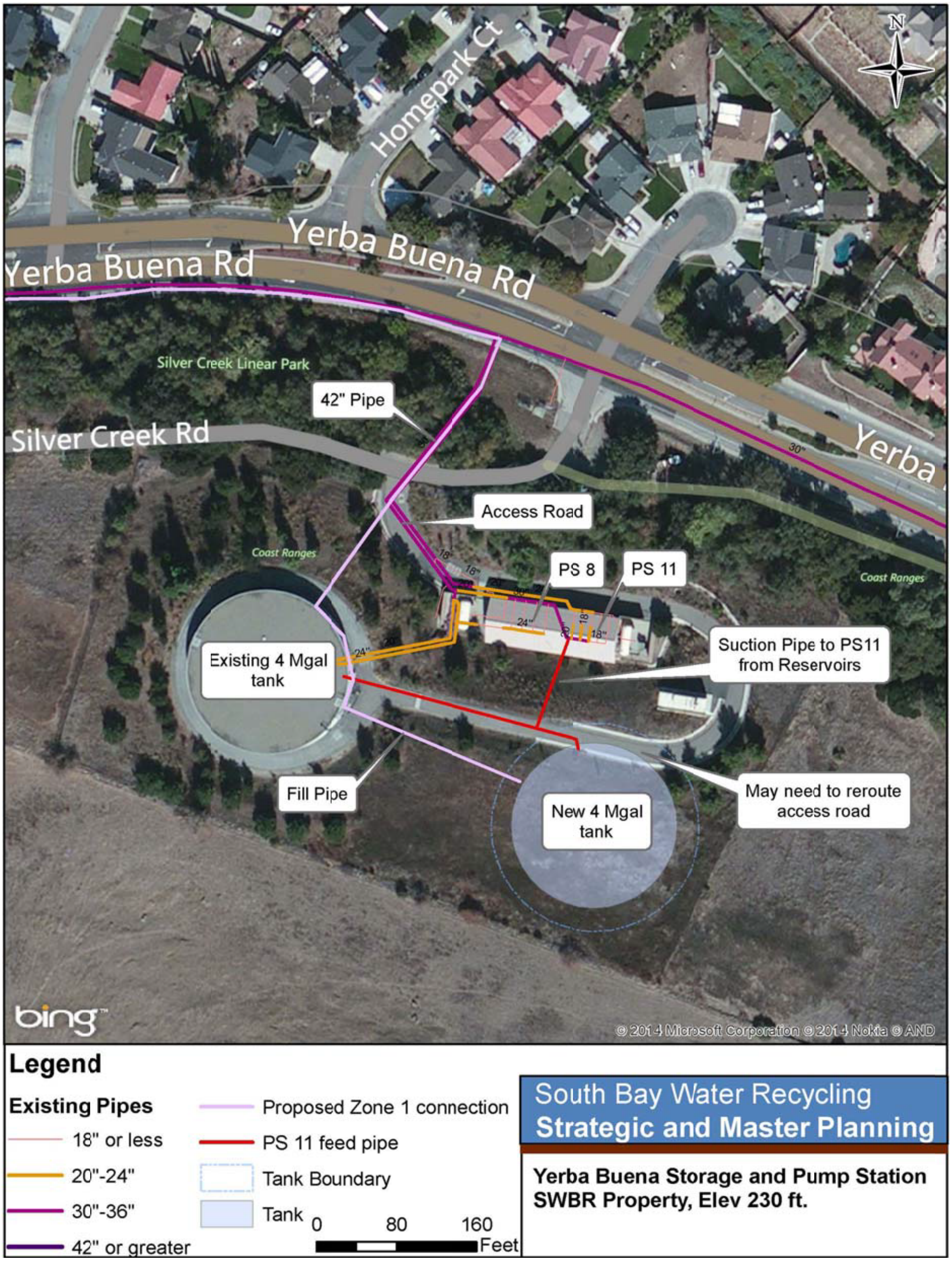
Background/Data Collection

The Yerba Buena Reservoir and Pump Station 8/11 site is owned by the City of San José as part of the existing SBWR system. The use of this site for Zone 1 storage has been considered previously and is being compared to the other storage options considered in this study. As part of this alternative, pump station 5 would be retired and the 42-inch transmission main in Senter Road would be converted to Zone 1. With this conversion existing Zone 2 customers would experience lower pressure from the system. To mitigate the lower pressure, new pipelines (basis of cost estimate) would be constructed to serve Zone 2 customers from pump station 8. Alternatively, package irrigation pump station could be implemented for customers that need additional pressure (alternative to be evaluated during pre-

- Converts a portion of Zone 2 customers to Zone 1 – Saves pumping energy associated with these customers
- Provides Zone 1 pressure stabilization as the Yerba Buena Reservoir elevation would set the hydraulic grade line for Zone 1 – Allows for upgrade of the pump control approach for TPS. Allows for TPS pumps to be operated at higher efficiency points rather than continuous adjustment to system pressures.
- Leverages the 2.25 MG of excess storage not needed for Zone 2 in the existing Yerba Buena

Figure 3-7 shows the site and a proposed 4 MG storage tank matching the existing storage tank at the site. This option would provide a total of 8 MG at the site with 1.75 MG assumed to be allocated for Zone 2 and 6.25 MG allocated to Zone 1

Figure 3-7: Overview of Yerba Buena Site



Existing Major Infrastructure at Yerba Buena Reservoir Site

- 4 MG Zone 2 pre-stressed concrete tank
- Pump Station 8 (Serves Zone 2 and provided the necessary feed pressure for Pump Station 11)
  - Four pumps at 75 hp and 2,000 gpm (with Variable Frequency Drives)
- Pump Station 11 (Serves Zone 3)
  - Three pumps at 500 hp and 4,300 gpm (Constant Speed)
  - One pump at 350 hp and 2,500 gpm (Constant Speed)
  - One pump at 250 hp and 900 gpm (Constant Speed)
- Existing yard piping to and from reservoir, to and from Pumps and Yerba Buena Road

New Infrastructure for Project

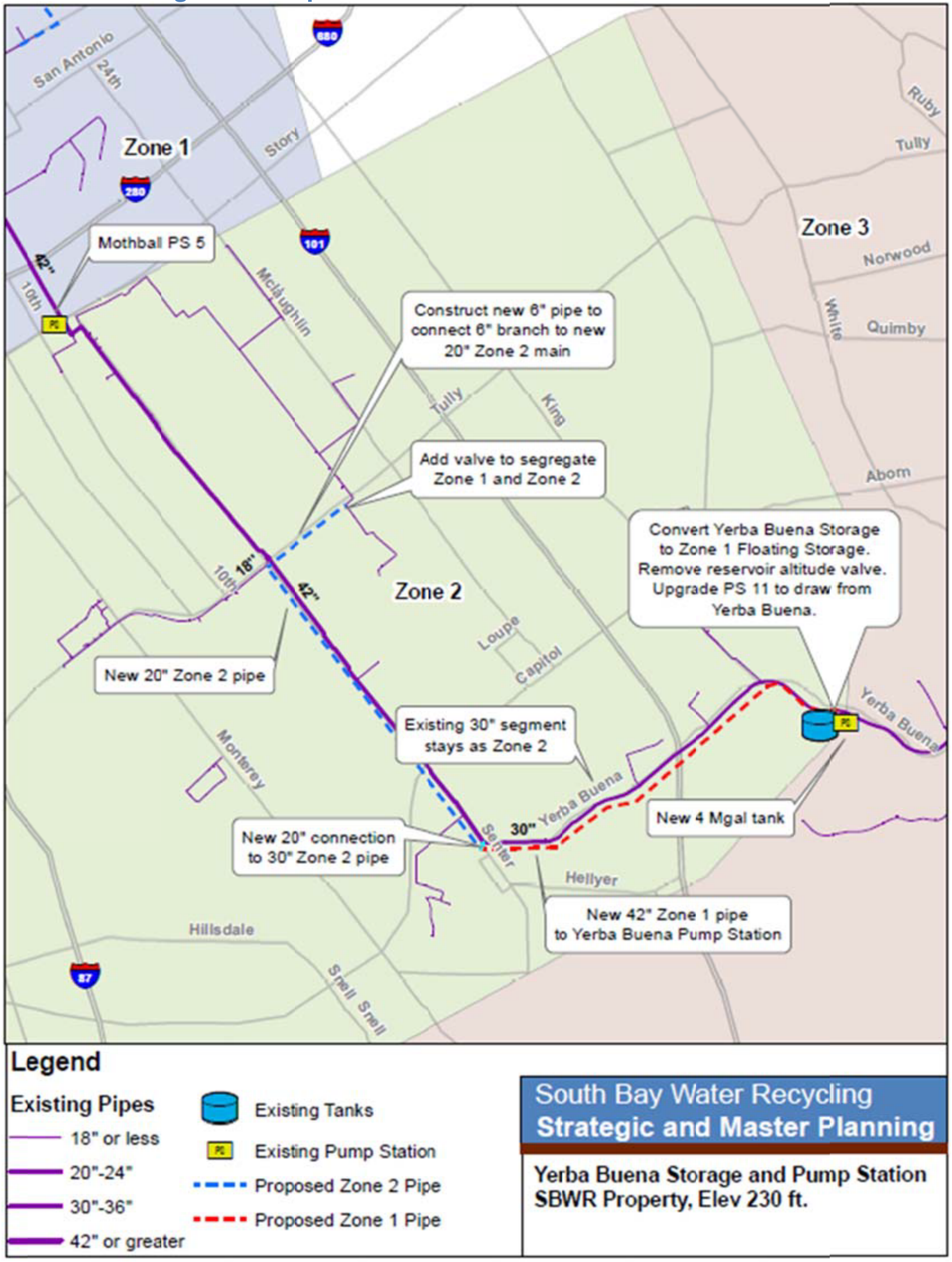
The following concept level infrastructure has been identified for the project.

- Zone 1 pipe: 11,800 of 42 inch pipeline from Senter Road/Sylvandale Ave. to the Yerba Buena reservoir site (See Figure 3-8). Needed to deliver water directly to Yerba Buena Reservoir with minimal headloss.
- Zone 2 pipe: 9,600 ft of 18 inch pipeline in Senter Road from Sylvandale Ave. to Tully Road.,
- 2,700 ft of 10 inch pipeline in Tully Road to connect to 6”main (See Figure 3-8)
- Pump Station 5 Bypass Pipeline Improvement
- Continue using PS 8 to serve Zone 2 demands (PS8 is connected to the existing 30-inch Zone 2 pipeline and would feed the Zone 2 pipe back toward Tully Road). Alternatively, retire PS8 and

Table 3-7 Yerba Buena Storage and Pump Station Characteristics

Characteristic	Criteria
Distance to Existing Transmission Line	Existing pipelines on site, 11,800 LF to largest diameter
Nearest Transmission Main Size	Site is located on the main backbone of the system. 42 inch diameter
Elevation	230 ft

Figure 3-8: Pipeline Additions and Zone 2 Modification[a]


San Antonio
24th
Zone 1
Story
280
680
101
Ruby
Tully
Zone 3
Norwood
White
Quimby
Mothball PS 5
42"
10th
McLaughlin
Construct new 6" pipe to connect 6" branch to new 20" Zone 2 main
Tully
King
Add valve to segregate Zone 1 and Zone 2
Abom
Convert Yerba Buena Storage to Zone 1 Floating Storage. Remove reservoir altitude valve. Upgrade PS 11 to draw from Yerba Buena.
18"
10th
42"
Zone 2
Loupe
Capitol
New 20" Zone 2 pipe
Existing 30" segment stays as Zone 2
Yerba Buena
Monterey
30"
Yerba Buena
New 4 Mgal tank
New 20" connection to 30" Zone 2 pipe
Senter
Hellyer
New 42" Zone 1 pipe to Yerba Buena Pump Station
Hillsdale
87
Snell
Snell
Legend
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
Proposed Zone 2 Pipe
Proposed Zone 1 Pipe
South Bay Water Recycling
Strategic and Master Planning
Yerba Buena Storage and Pump Station
SBWR Property, Elev 230 ft.

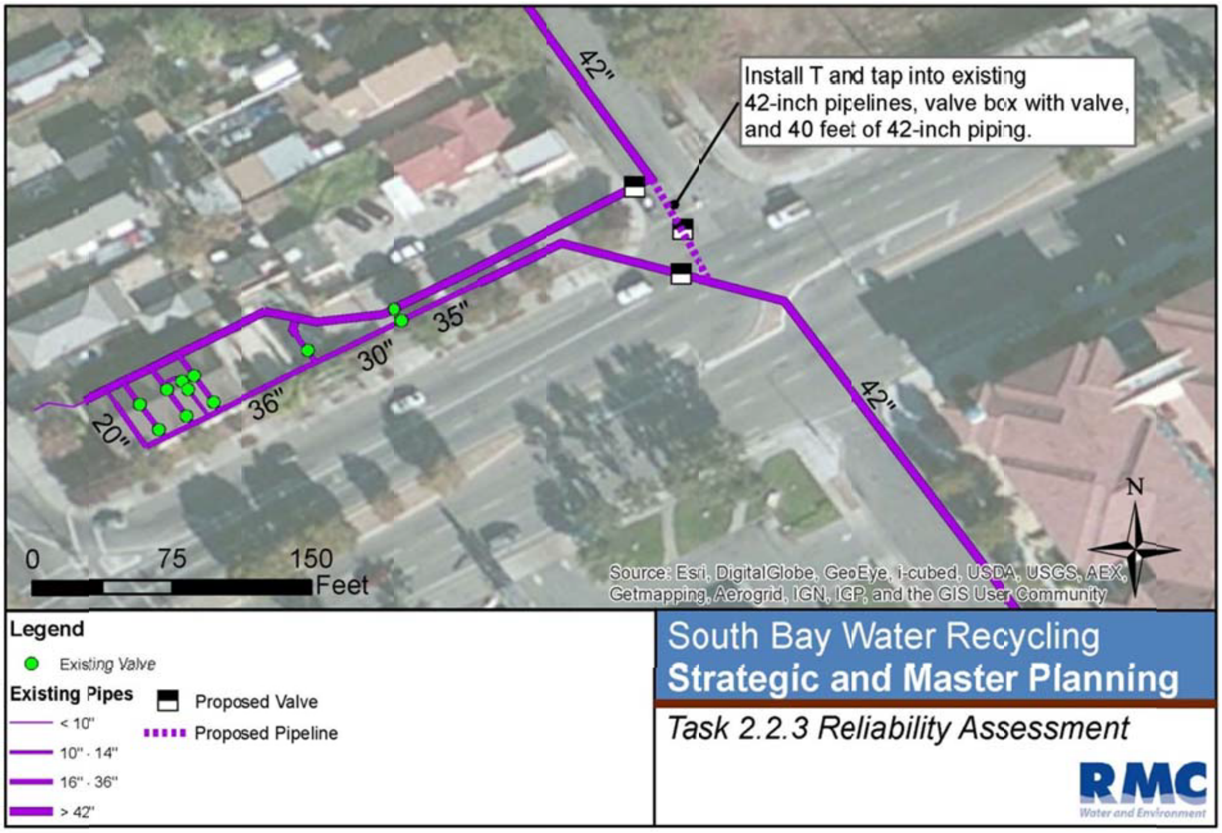
Footnotes:

a. These pipeline improvements represent one alternative for maintaining existing Zone 2 pressure to existing customers. Other alternatives like small onsite pump stations owned by customers should be

Pump Station 5 (PS 5) Bypass

The PS 5 bypass is a required element to allow TPS to fill Yerba Buena reservoir and for ultimate retirement of PS 5. Figure 3-9 shows the bypass concept on 12th Street.

Figure 3-9: Pump Station 5 Bypass


42"
Install T and tap into existing 42-inch pipelines, valve box with valve, and 40 feet of 42-inch piping.
35"
30"
36"
20"
42"
N
0
75
150
Feet
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
Legend
Existing Valve
Existing Pipes
< 10"
10" - 14"
16" - 36"
> 42"
Proposed Valve
Proposed Pipeline
South Bay Water Recycling
Strategic and Master Planning
Task 2.2.3 Reliability Assessment
RMC
Water and Environment

Pump Station 11 Replacement

This element is intended to simplify operation of Pump Station 11 by decoupling it from Zone 2. In the existing arrangement, the operation of Pump Station 5 and 8 needs to be coordinated with Pump Station 11 to provide adequate suction pressure and flow. In the new arrangement, Pump Station 11 will draw directly from the storage tank. This will require installation of pumps that can deliver a higher head to make up for the reduction in suction pressure. This project element is needed in conjunction with the SCVWD 5 mgd increase demand in Zone 3. The existing PS 8/11 arrangement is assumed to be adequate to meet existing demands based on Zone 2 and 3 max day demand of 8.3 mgd and PS 8 capacity of 8.6

Table 3-8: Pump Station 11 Design Criteria

Criteria	Units	Value
Total Design Flow Rate	gpm	9,300
No. of Pumps	-	3 Duty + 1 standby (match existing arrangement)
Design Flow rate per pump	gpm	2,700
TDH	ft	445
Pump hp, each	hp	500
Total hp	hp	2000

Hydraulic Modeling

Modeling of this alternative was completed to size the infrastructure and identify the modifications necessary to the system described above. The alternative allows TPS to operate with smooth flow transitions throughout the day that provides a more stable Zone 1 operation. Figure 4-4 in the

Modeling also indicated the following attributes relative to other alternatives:

- Zone 1 capacity enhancement by providing storage further south. Capability of supplying Zone 1 from two ends of Zone 1.
- Best alternative to move water to Zone 2 and 3. No bottleneck issues in transmission line.
- Elevated storage allows for simpler pump station controls.

Construction Considerations

Construction at the existing Yerba Buena site will require careful sequencing of work to maintain existing operation of the system and minimize shutdowns which may potential impact customers. Shutdowns should be planned during winter months to minimize the impact to existing customers. As Zone 3

Operations and Maintenance Estimates

The Yerba Buena Storage and Pump Station 5 retirement alternative is expected to reduce the operations and maintenance cost of the system. Retirement of pump station 5 reduces consumable cost, labor, and energy cost associated with the facility. Energy cost for PS 5 in 2013 was $144,000. Energy costs are expected to increase in the future with the increase in recycled water use in Zone 2 and

At the Yerba Buena Reservoir and PS 8/11 site, energy consumption would increase slightly as the pressure available from PS 5 would not be available. The saving achieved at pump station 5 would offset the incremental increase in energy at PS 8/11

The system operational effort for this alternative is projected to be slightly less than the existing system as the addition of Zone 1 elevated storage will minimize flow rate management and balancing that is currently required in Zone 1. The modification of PS 11 to draw directly from the reservoir also simplifies

4. Storage Site Comparison

Table 4-1 summarizes the key characteristics of the individual sites considered. For the 3 MG sizing for Cropley Station, Mabury Station, and Rabello, two sites must be implemented to provide the overall target 6 MG of storage. Cropley Station, Mabury Station, and Rabello can be paired in the following ways

- Rabello 3 MG and Cropley 3 MG
- Rabello 3 MG and Mabury 3 MG
- Mabury 3 MG and Cropley 3 MG

In addition, 6 MG of storage could be installed at the Cropley or Mabury Stations sites. A cost estimate was developed for 6 MG as Mabury Station and Cropley Station to evaluate the implications of using a single site for 6 MG of storage

The Yerba Buena alternative includes construction of an additional 4 MG tank which, when combined with the existing tank at the site, would provide the target 6 MG storage allocation for Zone 1.

Hydraulic modeling was performed to assess the flow and pressure characteristics of the above 6 MG alternatives. Generally, modeling results indicated the following:

- Elevated storage is desired as it better stabilizes Zone 1 pressures. It also provides a significant operational benefit as the TPS will experience smoother pressure and flow transition over the day.
- Locating storage closer to main transmission lines is a benefit as it requires less pumping to get water back to the transmission line (i.e. Mabury Station is a better location than Cropley Station due to proximity to transmission line)

Figure 4-1, Figure 4-2, and Figure 4-3 show how the TPS would operate without elevated storage where storage pump stations turn on and off and TPS adjusts to account for pump station flows. Without elevated storage, TPS will see rapid changes in flow rate as it will need to adjust as storage pump stations (constant speed) are turned on or off. A system without elevate storage will have more transient pressure issues and will require a more complex control system to mitigate undesired

Figure 4-4 shows TPS flows with elevated storage (an open water surface) for Zone 1 (Yerba Buena reservoir). The open reservoir results in smooth flow and pressure transitions throughout the day as demands changes and the reservoir is either filled or drained

Table 4-2 summarizes the alternative comparison including costs, benefits, and system characteristics.

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Table 4-1: Site Comparison Summary

Category	Cropley Station	Mabury Station	Rabello Site	Yerba Buena
Distance to Existing Transmission Line	Milpitas: 11,000 LF (to existing 20-inch) San José: 12,250 LF (to existing 18-inch)	10,000 LF to existing 42-inch	4,200 LF to existing 30-inch diameter	11,800 LF of 42-inch diameter piping need for Zone 1 Improvement
Elevation	125’	95’	5’	230’ (elevated storage)
Storage Potential (Circular)	6+ MG	6+ MG	~3 MG limit for Circular Tank	4 MG additional
Potential New Non-Potable Reuse	Milpitas: Parks and schools east of I680 (annual demand ~200AF) San José: Shares portion of planned SJWC “E”	Shares portion of planned SJWC “D” alignment	None	None
Environmental Constraints	There were no fatal flaws identified at Cropley Station, Mabury Station, or the Rabello site.			Site assumed viable as there are existing facilities
Pump Station Hp	600	600	750	NA
Zone 1 description	No elevated storage with multiple pump stations. Pressure transient issues likely to occur when pump stations turning on and off. Multiple pump stations flows rates need to be managed and controlled by operations to prevent high pressures, transient pressures, and unwanted pump			Open zone with Yerba Buena filling and draining as needed. Reduce pressure
Pump Station Annual Energy Consumption	593,000 kWh	644,000 kWh	845,000 kWh	NA
Project Partnership Opportunities	SJWC, Milpitas	SJWC	City of Santa Clara	SJWC

Table 4-2: Alternative Comparison

	Criteria	Cropley (3MG)/ Rabello (3MG)	Mabury (3MG)/ Rabello (3MG)	Cropley (3MG)/ Mabury (3MG)	Yerba Buena (4 MG) w/ New PS11[2,3]	Mabury Station (6MG)	Cropley Station (6MG)
	Economic						
1	Total Capital Cost	$38,000,000	$32,000,000	$41,000,000	$40,000,000	$27,000,000	$43,000,000
2	Annual O&M Costs	$679,000	$644,000	$631,000	-$277,000	$419,000	$491,000
3	Present Value O&M Cost	$13,000,000	$13,000,000	$12,000,000	-$5,000,000	$8,000,000	$10,000,000
4	Net Present Value (Capital and O&M)	**$51,000,000**	**$45,000,000**	**$53,000,000**	**$35,000,000**	**$35,000,000**	**$53,000,000**
5	San Jose Property Ownership (No Land Lease required)				X		
6	O&M Savings				PS5 Retired		
7	New PS 11 Asset				X		
8	PS5 Asset Renewal Savings				X		
9	Energy Grant funding				X		
	System Performance/Hydraulics						
10	Reduced Energy Consumption				X		
11	Minimize Pressure Transients				X		
12	Located Further South		X (Mabury)	X (Mabury)	X	X	
13	Close to Transmission Line		X (Mabury)	X (Mabury)	X	X	
14	Located Near Significant Demand	X (Rabello)	X (Rabello)				
15	Active Flow Control From Storage Tanks	X	X	X		X	X
16	Total Storage	6	6	6	6	6	6
	Other Benefits (Low Labor, Reliability, etc)						
17	Lowest Maintenance				X		
18	Simplest SCADA Operation				X		
19	Reduced Energy Consumption and Maintenance at TPS				X		
20	High Reliability Benefit for Retailer	SC (Rabello), SJWC (Cropley) and MP (Cropley)[2]	SC (Rabello), SJWC (Mabury)	MP (Cropley)[1], SJWC (Mabury, Cropley)	SJWC (YB) and Muni (Zone 3)	SJWC	MP[1], SJWC
21	High Multiple Zone Benefit				X (Zone 1, 2, and 3)		
22	No Zone 2 Service/Policy Impact	X	X	X		X	X
23	Zone 1 Distributed Storage Benefit	X	X	X			
	Design Benefits						
24	Additional Pipe Length Required	Cropley: SJ 10,500 LF[4] of 18”, 2,000 LF of 24”, MP: 11,000 LF of 20”	Mabury: 10,000 LF of 30” Rabello: 4,200 LF of 24”	Cropley: SJ: 10,500 LF[4] of 18”, 2,000 LF of 24”, MP: 11,000 LF of 20” Mabury: 10,000 LF of 24”	11,800 LF of 42-inch 9,600 LF of 20”	10,000 LF of 36”	MP: 11,000 LF of 20” SJ: 18,600 LF[4] of 36”
25	Required Hp for Zone 1 Pump Station	600/750	600/750	600/600	2000 (Replace - PS11)	1,000	1,000
26	Additional Zone 1 Pump Station Annual Energy Consumption	1,438,000 kWh	1,489,000 kWh	1,237,000 kWh	0 kWh	1,288,000 kWh	1,208,000 kWh
27	Site Elevation	Cropley 125 ft Rabello 5 ft	Mabury 95 ft Rabello 5 ft	Cropley 125 ft Mabury 95 ft	230 ft	95 ft	125 ft

Notes:

1. Assumes connector pipeline to Milpitas (MP) from Cropley Station Storage.
2. Includes PS5 O&M savings of $250,000 annually ($150,000 power and $100,000 in labor and consumables). Assuming $50,000 annual savings for PS5 Asset Renewal Savings

3. Retrofit of existing PS 11 would save an estimated $7.0M.
4. The 6 MG Cropley Alternative requires a 36” pipeline to be constructed back to the 42-inch transmission main. The 3 MG Cropley ties into existing 18-inch on Hostetter Road.
5. No reservoir constructed at Yerba Buena, using available 2.25 MG surplus storage at existing reservoir.
6. 2020 Up to support construction of future YB reservoir

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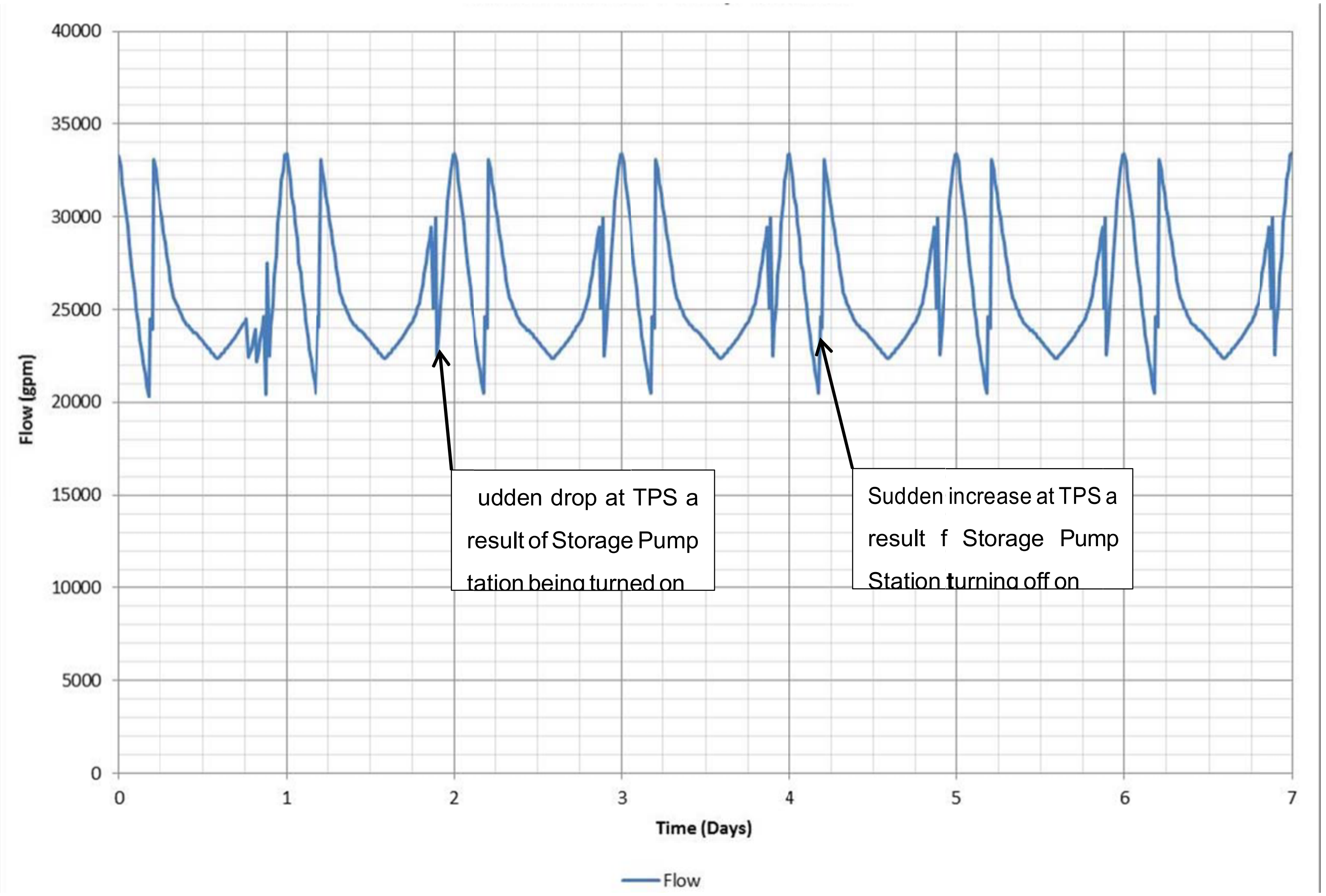
Figure 4-1: TPS Flow without Elevated Storage (Rabello and Cropley Station)



udden drop at TPS a result of Storage Pump tation being turned on

Sudden increase at TPS a result f Storage Pump Station turning off on

Figure 4-2: TPS Flow without Elevated Storage (Rabello and Mabury Station)

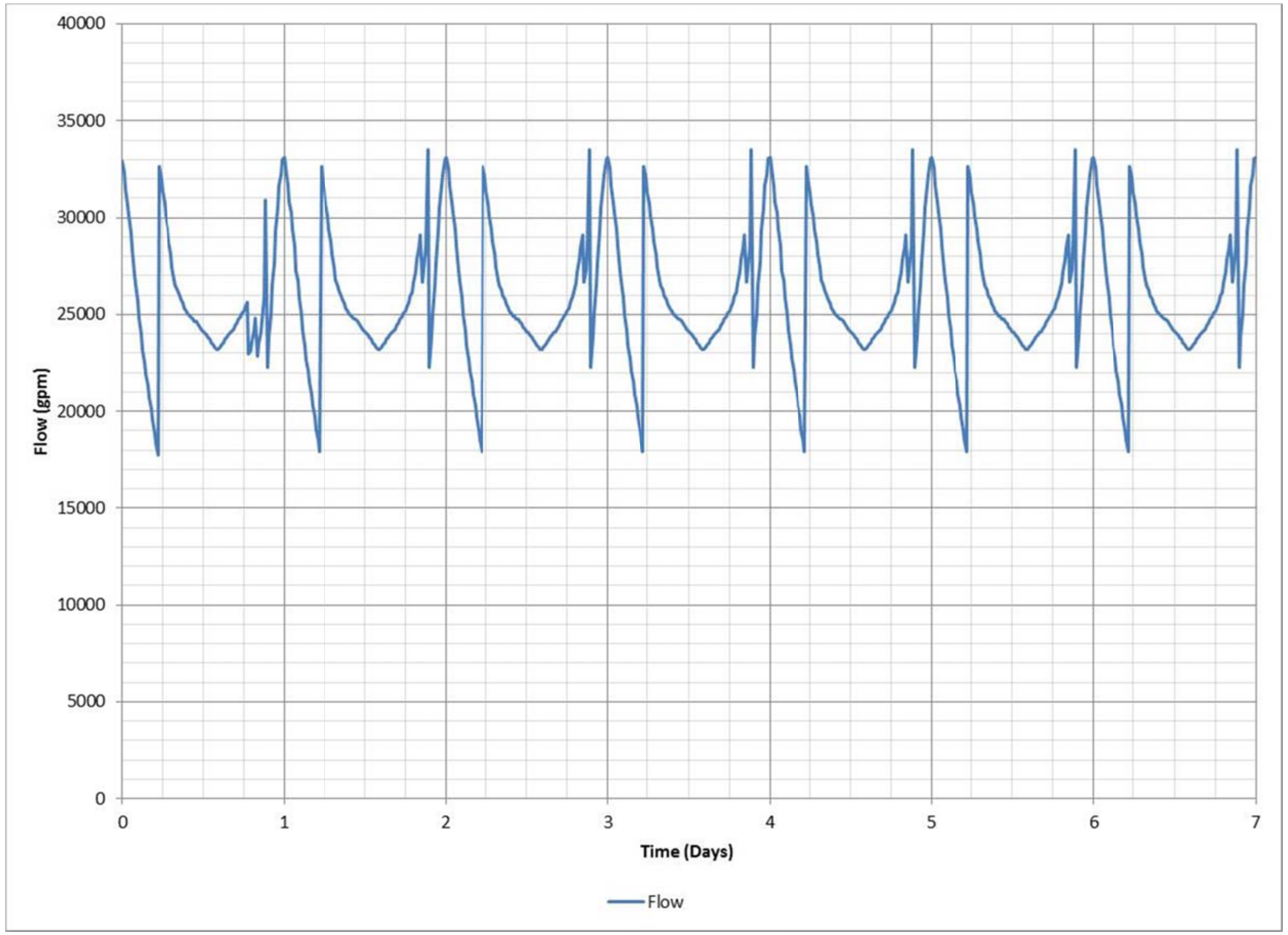


Figure 4-3: TPS Flow without Elevated Storage (Cropley and Mabury Station)

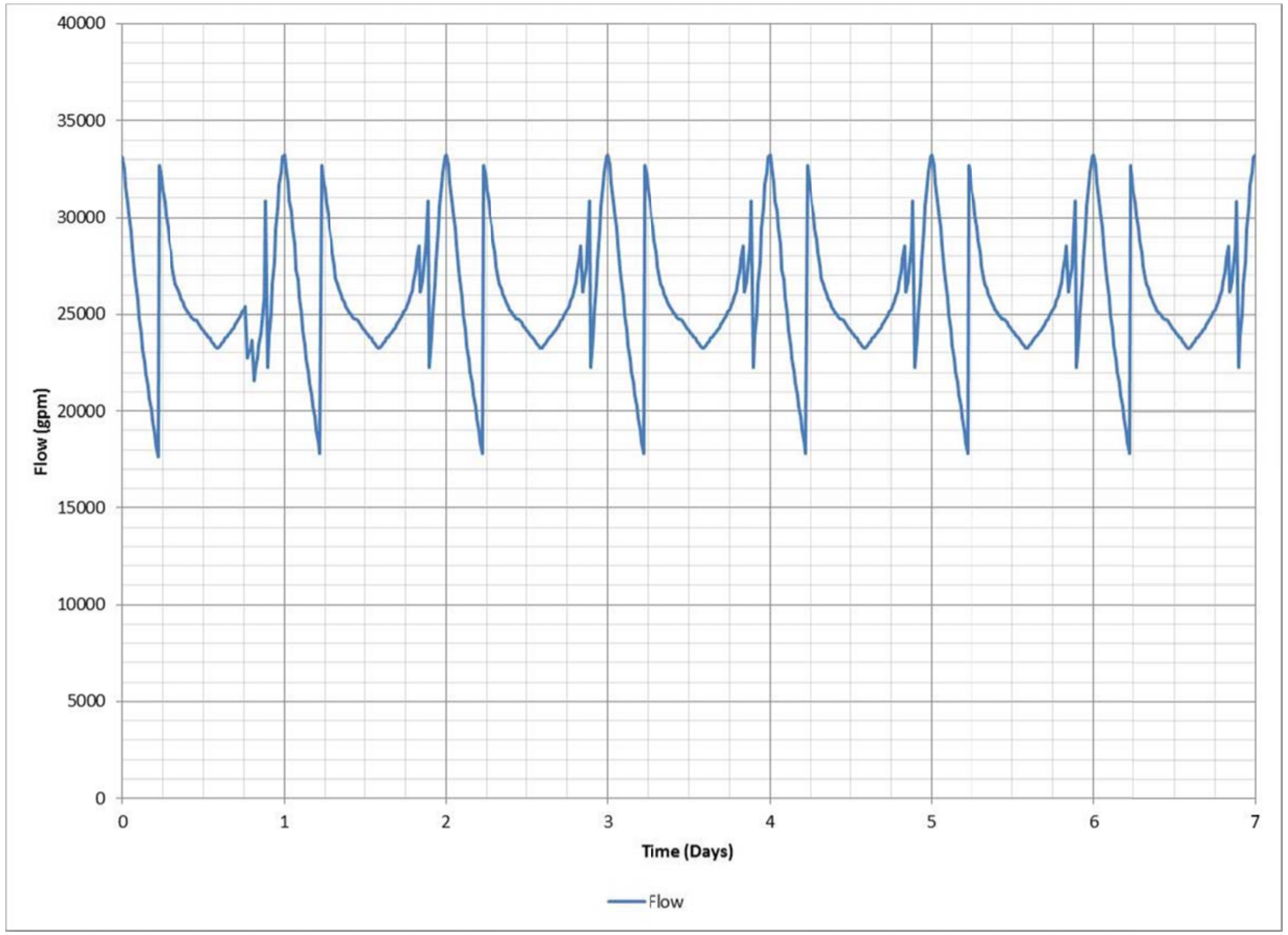
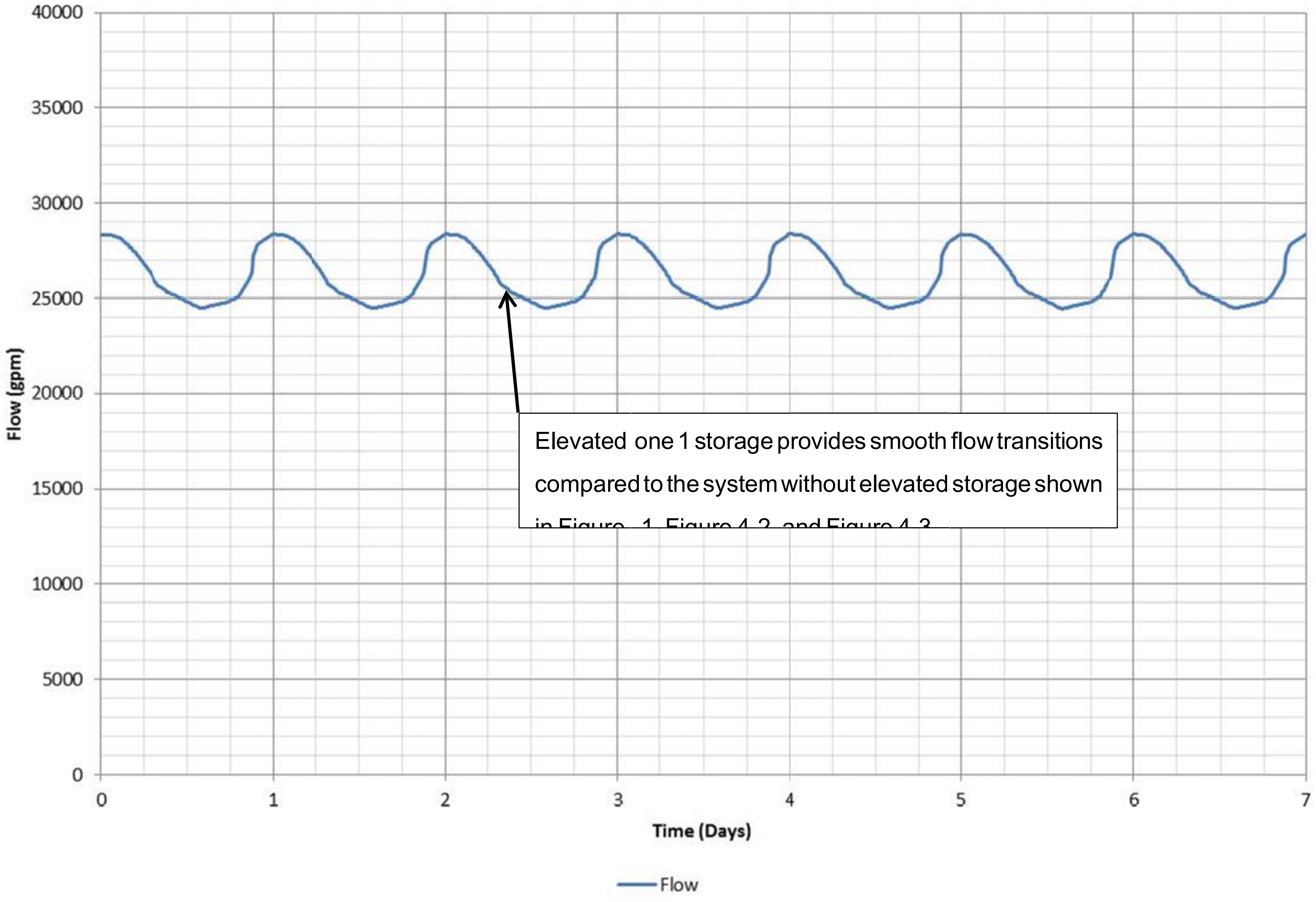


Figure 4-4: TPS Flow with Elevated Storage (Yerba Buena Storage)



Elevated one 1 storage provides smooth flow transitions compared to the system without elevated storage shown in Figure 1, Figure 4-2, and Figure 4-3

4.1 Estimated Costs

The capital cost estimates for the storage alternatives were developed based other similar storage projects, cost quotations from tank suppliers, industry publications, and typical pipeline installation costs in terms of cost per inch of pipeline length and inch diameter. Depending on the stage of the project and the level of detail understood, different estimating accuracies can be assumed. Since the SBWR Strategic and Master Planning project is a preliminary planning phase project, these estimates are considered Class 5 estimates based on the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries (2005). Class 5 estimates are based on a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate is -20 to -50

- 20 percent contingency to account for unknown or unforeseen construction costs.
- 30 percent implementation factor to account for the costs for program management, planning and environmental documentation, permits, engineering, design and construction services, construction management and inspections, and typical overhead items such and legal and administration services.
-

O&M costs are the recurring annual expense to operate and maintain the facilities after construction is completed. The O&M cost elements include items such as power, operation and maintenance labor, and replacement of consumables (instruments, pumps, electrical equipment). The O&M cost estimates for the storage alternatives are developed based on similar storage projects, replacement equipment costs,

Table 4-3 summarizes the cost for a 3 MG storage tank, pump station, and transmission infrastructure at the three non-elevated storage sites. Rabello has the lowest capital cost as it has the shortest pipeline length to connect to the main transmission loop in Santa Clara. Rabello has the highest energy consumption and cost due to the low elevation of the site. Cropley has the highest capital cost due to

Table 4-4 pairs the sites together to identify 6 MG alternatives and includes the estimated cost of the Yerba Buena and PS 5 retirement alternative which would effectively provide 6 MG for Zone 1. Table 4-4 also shows the estimated cost for a Cropley Station 6 MG project and Mabury Station 6 MG project. Mabury Station 6 MG project has the lowest capital costs and present value costs (Note that O&M cost saving for PS 5 retirement and other element savings could make the Yerba Buena Alternative

Table 4-3: "Individual" Site Estimated Cost Comparison (3 MG Tank)

Element	Cropley Station	Mabury Station	Rabello Site
Pipelines	$7,562,000	$4,090,000	$1,862,800
Storage Tank	$3,000,000	$3,000,000	$3,000,000
Pump Station	$3,100,000	$3,100,000	$3,600,000
Raw Construction Cost	**$13,700,000**	**$10,200,000**	**$8,500,000**
Construction Contingency (20%)	$2,700,000	$2,000,000	$1,700,000
Total Construction Cost	**$16,400,000**	**$12,200,000**	**$10,200,000**
Implementation (Program Management, Design, CEQA, Legal, CM) (30%)	$4,900,000	$3,700,000	$3,100,000
Project Contingency (10%)	$2,100,000	$1,600,000	$1,300,000
Total Capital Cost	**$23,400,000**	**$17,500,000**	**$14,600,000**
Annual O&M Costs[1]	$330,000	$300,000	$350,000
Present Value O&M[2]	$6,500,000	$5,800,000	$6,800,000
Total Present Value	**$29,900,000**	**$23,300,000**	**$21,400,000**

Notes:

1. Annual O&M includes a site lease of $100,000 per year for each site.
2. Present value O&M based on 3.0% interest rate and 30-year term.

Table 4-4: Zone 1 - 6 MG Estimated Cost Comparison

Element	Cropley Station and Rabello	Mabury Station and Rabello	Cropley Station and Mabury Station	Yerba Buena Storage and PS 5 Retirement[2,3]	Mabury Station (6 MG)	Cropley Station (6 MG)
Total Capital Cost	$38,000,000	$32,000,000	$41,000,000	$40,000,000	$27,000,000	$43,000,000
Annual O&M Costs	$679,000	$644,000	$631,000	-$277,000	$419,000	$491,000
Present Value O&M[1]	$13,000,000	$13,000,000	$12,000,000	-$5,000,000	$8,000,000	$10,000,000
Total Present Value	**$51,000,000**	**$45,000,000**	**$53,000,000**	**$35,000,000**	**$35,000,000**	**$53,000,000**
Potential Land Lease Required	X	X	X		X	X

Notes:

1. Present value O&M based on 3.0% interest rate and 30-year term.
2. The Yerba Buena Storage, PS 5 Retirement, Operational Enhancement Alternative cost estimate assumes a Zone 2 pipeline back to Tully Road. Significant cost saving may be possible with customer irrigation pump stations.
3. Includes PS 5 O&M savings of $250,000 annually ($150,000 power and $100,000 in labor and consumables). Assuming $50,000 annual

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5. Storage Recommendation

Based on the alternative comparison, the Yerba Buena alternative appears to be the best value based on cost and benefits. This recommendation was presented to SBWR staff at a November 4, 2014 workshop and attendees agreed with having Yerba Buena as the recommended alternative. Benefits of the project

- Simplest operation (Alternative with lowest number of pump stations)
- Best Zone 1 hydraulics (elevated storage)
- Reduction of O&M and reduction asset replacement cost at PS 5. Potential PS5 property sales value.
- Consolidation of new storage into existing Yerba Buena site. Does not add additional site(s) that will need to be operated and maintained
- SBWR owned property (No land lease which may be required with other sites)
- Based on hydraulic modeling, storage located further south from TPS alleviates the peak hour flows that would need to be conveyed in the 42-inch Senter Road transmission line which helps

The Yerba Buena Reservoir/Pump Station 5 Retirement project could be phased to spread out capital expenditures and meet cash flow requirements. A potential phased approach includes:

Phase 1: 42-inch Zone 1 Pipeline, 18-inch Zone 2 Pipeline, PS 5 Bypass Connection
Phase 2: Additional 4 MG Storage
Phase 3: New PS 11 (in conjunction with SCVWD 5 mgd demand in Zone 3)

Table 5-1 summarizes the estimated capital cost for each phase.

Table 5-1: Recommended Phased Implementation Capital Cost Estimate

Element	Phase 1: 42-inch, 18-inch, PS 5 Bypass	Phase 2: 4 MG Storage	Phase 3: New PS 11
Construction Cost	**$14,600,000**	**$5,400,000**	**$7,800,000**
Implementation Cost (30%)	$4,400,000	$1,600,000	$2,300,000
Project Contingency (10%)	$1,900,000	$700,000	$1,000,000
Total Capital Budget	**$20,900,000**	**$7,700,000**	**$11,100,000**

6. Implementation Plan

Predesign

The next step in the technical development of the project is to complete predesign. This will entail developing a predesign report (3% to 5% design) for the recommended alternative including of general arrangement drawings for the storage tank and pump station 11 upgrades, site and yard piping drawings, and infrastructure plans for Yerba Buena Road and Senter Road. A key question to be answered on the pipeline alignment is how and where to cross Coyote Creek. The Coyote Creek crossing is expected to be tunneled and will have environmental permitting requirements due to waterway crossing and habitat. Tunneling operations require adequate construction stage area (may require

The Predesign should also evaluate the feasibility of providing onsite irrigation pump stations that can take water directly from Zone 1 in lieu of installing new Zone 2 pipelines. I.e. small package onsite pump stations at the cemetery and other customers may have significant cost savings benefit compared to

Outreach with existing Zone 2 users should be completed to define flow and pressure requirements for the existing irrigation systems as Zone 2 capacity will be reduced to more modest levels with the retirement of PS 5. Existing Zone 2 customers that would be converted to Zone 1 should also be

The predesign report will provide the project definition needed to initiate environmental review.

Financing Plan

Development of a financing plan and strategy will be a key task that dictates the schedule for the project. Typically, recycled water projects are financed through a combination of grants, partnerships

The SRF program is typically used to cover financing and cost not covered by grants and partnerships. The SRF program offers 30 year financing at an interest rate of ½ the most recent General Obligation (GO) Bond Rate at time of funding approval. The interest rate has ranged from 1.7 percent to 3.0 percent over the last 10 years. Currently, the SRF program has 1% financing available through December

However, initial discussions with City staff have indicated that project financing may not be a viable option due to planned borrowing for the Regional Wastewater Facility upgrades. If this is the case, the project would be on a "pay as you go" approach which would require developing a capital reserve fund

A "pay as you go" approach would push the project schedule out as capital funds would need to be collected and saved over several years to pay for construction. The project infrastructure could also be constructed in phases which would spread capacity expenditures. For example, the project pipeline infrastructure could be constructed first with the 4 MG storage tank and PS 11 renovation occurring at a

Grant funding may be available through the following programs:

- Reclamation WaterSMART program which provides up to 25% reimbursement of project cost

- PG&E energy conservation programs
- Proposition 84 funding
- Proposition 1 Recycled Water funding

SCVWD may also participate in the project as the overall capacity of the system will be increased providing a water supply benefit for the region. The new PS11 is also a project needed to support 5 mgd delivery of additional recycled water to Zone 3 where SCVWD has plans for an Indirect Potable Reuse

Environmental Review and Compliance

CEQA review and compliance is a major task and milestone for the Zone 1 storage project. The environment review process should begin following the predesign task or as soon as the recommended project elements are defined. The CEQA process is expected to take up to 12 months. If SRF financing

A property acquisition assessment should begin during predesign although final property acquisition is dependent upon CEQA Plus compliance and would typically be completed in conjunction with the end of the CEQA process

Design and Construction

The design phase of the project could be conducted concurrently with the CEQA Plus compliance process; this will reduce the implementation schedule although this approach may lead to some re-design to address CEQA concerns. Necessary permits should be obtained concurrently with design phase efforts. These permits may include, but are not limited to, Regional Water Quality Control Board

A preliminary implementation schedule for the Zone 1 storage project is shown in Figure 6-1 assuming the ability to finance the improvements with SRF funds and construction of the project as one package. In a “pay as you go” approach, the schedule would be delayed until adequate capital funds were saved to support the project and a phase implementation approach would be developed. Figure 6-2 shows an example phased implementation schedule to spread-out capital expenditures. The actual implementation schedule will depend on financial capabilities, recycled water rate policies, grant

Figure 6-1: Zone 1 Storage One Project Implementation Schedule (Assumed Financing)

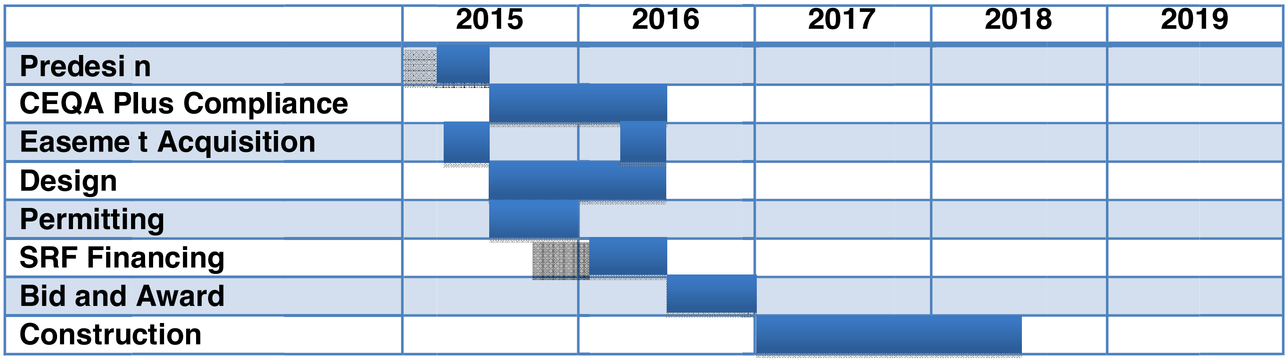
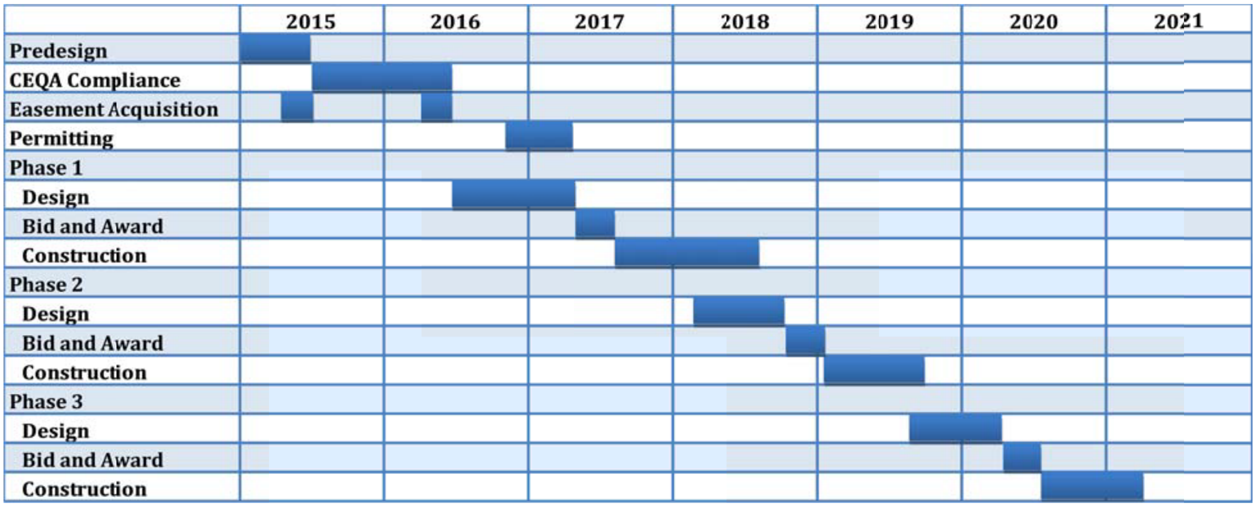


Figure 6-2: Zone 1 Storage Phased Implementation Schedule (Pay as you go Financing)



Appendix 4D - Zone 1 Storage Siting Study Environmental Constraints Analysis

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ESA

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memorandum

date	October 31, 2014
to	Marc Nakamoto, RMC Water and Environment
from	Julie Moore
subject	South Bay Water Recycling Project Strategic and Master Planning Zone 1 Storage Siting Study Environmental Constraints Analysis - FINAL

Purpose of this Memorandum

This memorandum provides a comparative assessment of environmental constraints associated with three Zone 1 storage tank alternatives and pipeline connections proposed for the South Bay Water Recycling Project, as shown on Figure 1, Project Vicinity. This memorandum updates our previous memorandum dated October 9, 2014 to include two pipeline variants for the Rabello Pump Station: Variant 1) the original short interconnection to a 16-inch line south of the site; and, Variant 2) a new 0.75-mile Lafayette Street alignment. The purpose of the environmental constraints review was to identify any "fatal flaw" issues, primarily with respect to biological and cultural resources. This work was performed in accordance with our scope of work to RMC Water and Environment dated May 22, 2014.

Results of the Analysis

A summary of the environmental concerns for each of the three tank alternatives is presented in Table 1. The analysis indicates that there are no environmental constraints or fatal flaws which would prohibit selection of any of the alternatives; however, Variant 2 of the Rabello pipeline interconnection would avoid potential interference with the All Purpose Landfill's leachate extraction system and environmental permitting that could be required for a small wetland feature. The following is a summary of our findings.

Land Use

Because the three tank sites would be located within existing water or wastewater utility parcels, the proposed storage tanks would not divide existing land uses and would be consistent with current uses of the parcels.

Traffic

Construction-related traffic impacts would correspond to the pipeline length and construction duration, assuming that road or lane closures would be required for installation of pipelines within roadways.

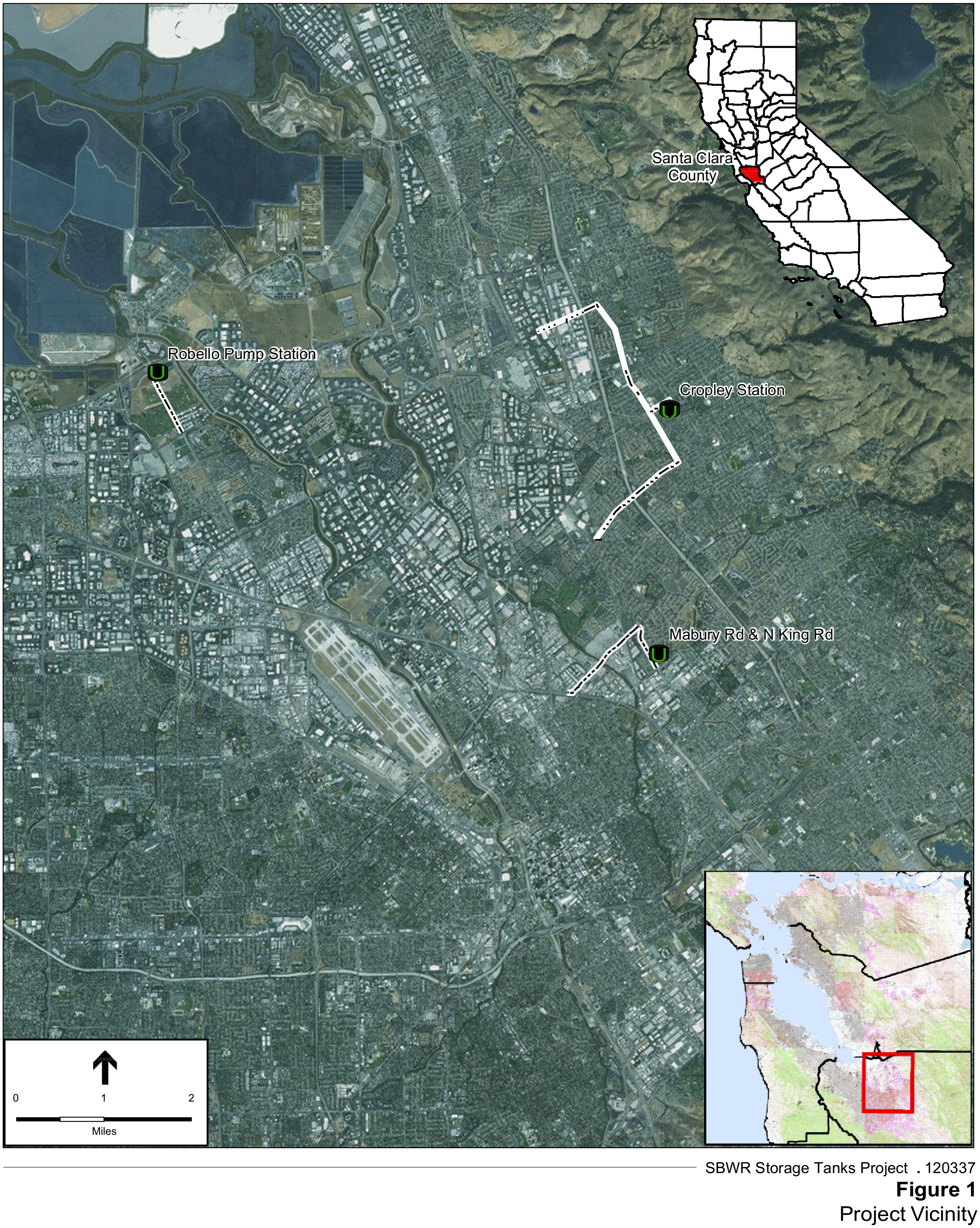


Figure 1
Project Vicinity

Approximate pipeline lengths are Cropley Station pipeline alignment (4.4 miles); Mabury Station pipeline alignment (1.7 miles); Rabello alignment Variant 2 (0.75 mile); and Rabello Variant 1 (no roadways affected).

Noise and Vibration

Sensitive receptors (residences) border the Cropley and Mabury sites and their respective pipeline alignments; no sensitive receptors are in close proximity to the Rabello site. While the San Jose Noise Ordinance limits construction hours, it does not provide construction noise limits. However, noise mitigation measures would be recommended for certain construction activities, such as pile driving (if required for tank foundations).

Air Quality and Greenhouse Gas Emissions

Construction air quality impacts would be similar for each of the alternatives, although the Cropley alternative would involve the greatest amount of construction-related air quality impacts due to the length of pipeline required.

Geology and Soils

Evaluation of geologic constraints is based on review of available mapping of faults, landslides, and liquefaction in the project vicinity, as shown on Figure 2. As shown, none of the tank sites are located within Alquist Priolo Fault Zones or earthquake induced landslide zones. The tank sites and alignments are located primarily in areas of low slopes and low landslide hazards, with the exception of the proposed interconnection pipeline at the Rabello site, would be located within the slope of the adjacent landfill.

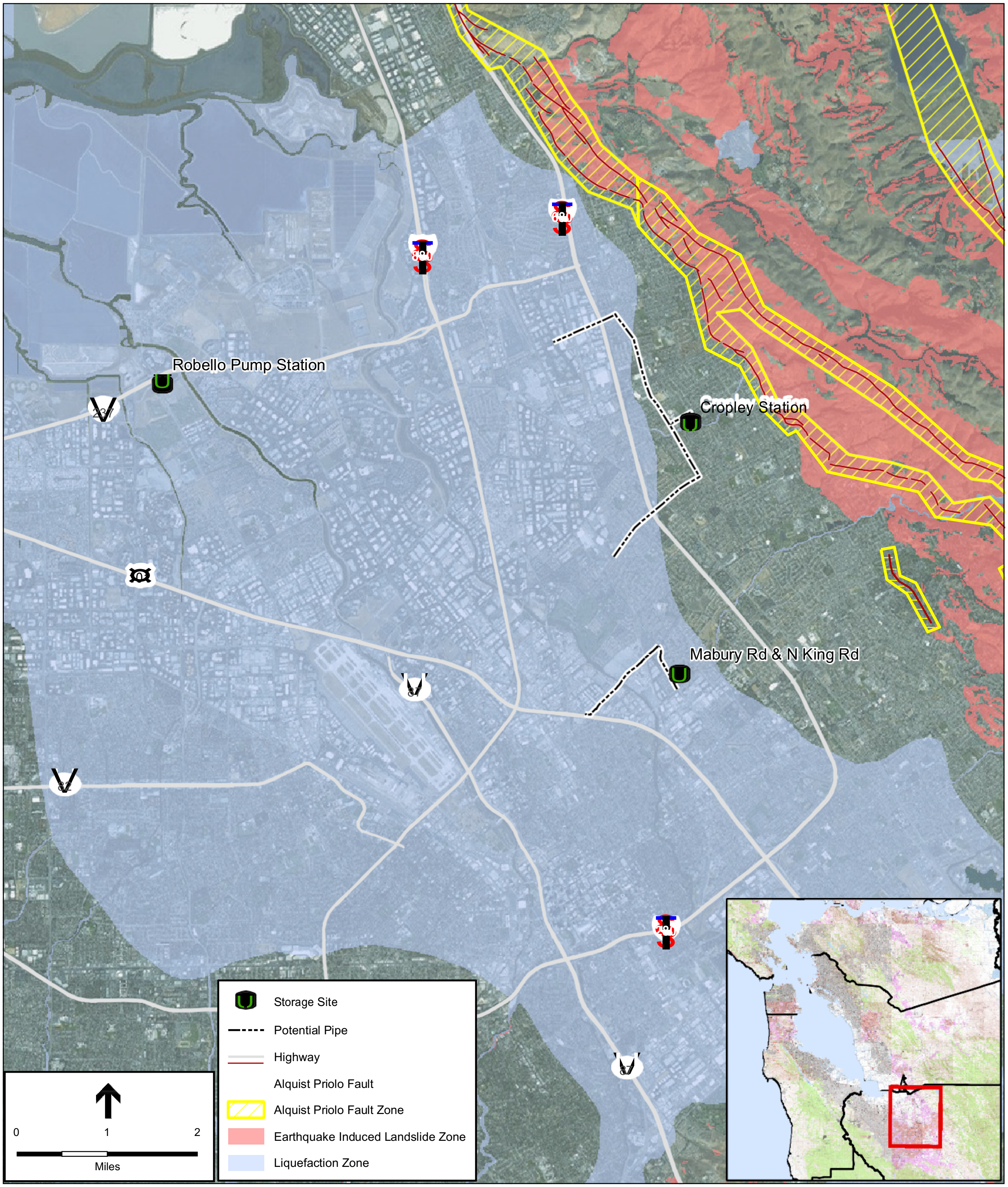
The Rabello Pump Station and pipeline, Mabury Station and pipeline, and portions of the Cropley pipeline alignment would be located within liquefaction hazard zones, requiring appropriate geotechnical tank foundation design.

Hydrology and Water Quality

Surface water drainages are located adjacent to all three tank sites, although elevated berms next to Berryessa Creek (Cropley) and Penitencia Creek (Mabury) appear sufficient to prevent the runoff of construction storm water discharges from these sites into the adjacent drainages. At Rabello, construction stormwater best management practices (BMPs), including a silt fence and straw wattles, were in place during our site visit for the yard’s current use as a construction staging area. At a minimum, these BMPs would be needed during storage tank construction.

Hazardous Materials

Review of regulatory agency databases of hazardous materials sites in the project vicinity identified open and closed leaking underground storage tank (LUST) sites, active remediation sites, and a former landfill. A summary of the hazardous sites identified near each alternative is included in Attachment 1. Excavation and grading for construction could encounter hazardous materials present in soil and/or groundwater, which could expose construction workers and require disposal of excavated soil or dewatering fluids as hazardous waste. For any alternative, it would be advisable to prepare a health and safety plan and a contingency plan that provide for protocols in the event unanticipated hazardous materials are encountered during construction.



SOURCE: CDMG

SBWR Storage Tanks Project . 120337

Figure 2

Geologic Hazard Map

Rabello **–** The Santa Clara All Purpose Landfill is located adjacent to the south of the project site. The original short interconnection pipeline (Variant 1) would be located within the landfill slope, in generally the same area as three leachate extraction sumps which are at the base of the landfill slope, adjacent to the site (the exact location cannot be ascertained from the available online monitoring report). In addition, groundwater in this area could be affected by volatile organic compounds (VOCs) that have been detected in landfill groundwater monitoring. Rerouting of the Variant 1 pipeline alignment could avoid potential interference with the landfill's clay liner and leachate extraction system; the Lafayette Street alignment (Variant 2) appears to avoid these landfill systems.

Cropley **–** Nine closed and two open LUST sites are located along the pipeline alignment. The potential to encounter soil and/or groundwater contamination during pipeline excavation is low to moderate.

Mabury – Ten closed LUST sites and four open remediation sites are located along the pipeline alignment. Due to the size and nature of the industrial facilities near the southern end of Berryessa Road near the Bayshore Freeway, the potential to encounter soil and/or groundwater contamination is moderate to high.

Cultural Resources

The methodology and findings of the cultural resources investigation are presented in Attachment 2.

Historic architectural resources include buildings, structures (i.e. bridges), objects, and historic districts.

The Mabury Station pipeline alignment crosses two historic-era bridges. Both bridges have been evaluated and were determined to be ineligible for listing in the National Register of Historic Places. All three alternatives would have no impact on historic architectural resources.

Prehistoric archaeological resources relate to Native American sites. Materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs). Human remains may also be associated with prehistoric sites.

Recorded prehistoric archaeological sites have been identified in the vicinity of all of the tank alternative locations; however, none are known to occur within the project sites themselves. Based on the number and location of previous investigations in the vicinity, there remains a moderate potential to encounter unanticipated prehistoric archaeological resources at all of the proposed alternative sites.

Historic-era archaeological resources relate to the Spanish, Mexican, or early American periods. Materials might include stone, concrete, or adobe footings and walls; artifact filled wells or privies; and deposits of metal, glass, and/or ceramic refuse.

No historic-era archaeological resources were identified at the project sites; the potential to encounter unanticipated resources is considered low.

Paleontological resources include fossilized remains of vertebrate and invertebrate organisms, fossil tracks and trackways, and plant fossils.

Proposed tank site alternatives are located on geologic units of low paleontological potential; therefore, the potential to encounter paleontological resources would be low.

Biological Resources

Project sites are primarily developed water utility yards with scant biological resources onsite, and nearby drainages. Nesting bird surveys are recommended at each of the sites due to the adjacent marsh or drainage features. At Rabello, a small, isolated patch of potential wetlands was noted south of the fenceline at the base of the landfill, seemingly the result of drainage from the landfill or a leaking sewer pipeline located uphill. Resource agency permitting could be required for construction, which could take between several months and a year (estimated budget of $15,000 to $50,000). At Mabury, removal of walnut trees located in the center of the site would require a tree removal permit, public noticing and hearing.

Figures

Figure 1: Location Map
Figure 2: Geologic Hazards

Attachments

Attachment 1: Hazardous Materials Constraints Analysis
Attachment 2: Cultural Resources Constraints Analysis (Not for public distribution – contains confidential information)
Attachment 3: Biological Resources Constraints Analysis

TABLE 1
ENVIRONMENTAL CONSTRAINTS ANALYSIS SUMMARY FOR ALTERNATIVE TANK OPTIONS

Rabello Pump Station – Alternative 1	Cropley Station – Alternative 2	Mabury Road & North King Road – Alternative 3
Site Description and Land Use		
The City of Santa Clara's Rabello Pump Station is an existing facility located east of the intersection of Lafayette Street and Great America Way, just south of Highway 237. A former landfill borders the site to the south; a BMX track is located on top of the landfill. A golf course occupies land south and west of the landfill. Wetland areas and a trail abut the site to the north; a storage pond is adjacent to the east of the pump station; the Guadalupe River is further east. A multi-story office building is located across Lafayette Street to the west. The proposed tank would occupy a vacant, paved area within this facility. There are two pipeline variants for interconnection: Variant 1 - A short pipeline to interconnect with an existing 16-inch line just south of the site along the landfill slope. Variant 2 – A 0.75-mile pipeline in Lafayette Street to Tasman Drive.	The proposed Cropley tank would be situated within a triangularly-shaped parcel owned by San Jose Water Company. The site is occupied by groundwater wells, a pump station, a small storage tank, and a communications tower. The southern portion of the site is generally undeveloped and occupied by weedy grasses and vegetation. Residential homes that border the east and west sides of the parcel are generally shielded from views of the site by intervening fences, trees and shrubs. Berryessa Creek Park is located to the south. The proposed recycled water pipeline to Cropley tank would be located in Cropley Avenue, Morrill Avenue, Hostetter Road, and Yosemite Drive. A total of 23,300 feet of pipeline (4.4 miles) would be required.	The Mabury site is also a triangularly-shaped parcel owned by San Jose Water Company surrounded by residential homes to the east and west; Penitentia Creek borders the northern side of the site. The property is also occupied by some groundwater wells, a small tank and building. A landscaping company has been leasing the property for storage of soil, mulch, planters, equipment and other materials. The site is predominantly undeveloped and occupied by weedy vegetation and several large walnut trees. The proposed recycled water pipeline to the Mabury tank would be located in Berryessa Road to Lundy Avenue. A total of 8,800 feet (1.7 miles) of pipeline would be needed.
The proposed water tank would be consistent with current land uses of the site.	The proposed water tank would be consistent with current land uses of the site; however, the scale of the tank would be substantially larger than the existing on-site storage tank. Users of the trail in Berryessa Creek Park adjacent to the southern property boundary would have views of the proposed tank. Additional landscaping along the southern fence to shield views may be desirable.	The proposed water tank would be consistent with current land uses of the site; however, the scale of the tank would be substantially larger than the existing tank. Users of the trail adjacent to Penitentia Creek and some nearby residents would have views of the proposed tank.
Traffic and Circulation		
Variant 1 - No road closures or lane closures for construction would be required. Variant 2 – Shortest pipeline (0.75-mile) in roadway of the three alternatives.	This option requires the longest pipeline alignment (4.4 miles); therefore, it would have the greatest impact on traffic due to construction in roadways.	This option would also cause some traffic impacts, assuming closure of one lane for construction (1.7 miles).
Noise and Vibration		
There appear to be no sensitive noise receptors in the project vicinity; therefore, construction noise impacts would be limited.	The San Jose Municipal Code limits hours of construction within 500 feet of a residential unit to 7am to 7pm; there are no restrictions on construction noise levels. Construction activities could cause noise impacts on adjacent residences, particularly if sheet-pile driving was needed for foundation construction.	The San Jose Municipal Code limits hours of construction within 500 feet of a residential unit to 7am to 7pm; there are no restrictions on construction noise levels. Construction activities could cause noise impacts on adjacent residences, particularly if sheet-pile driving was needed for foundation construction.

TABLE 1 (Continued)
ENVIRONMENTAL CONSTRAINTS ANALYSIS SUMMARY FOR ALTERNATIVE TANK OPTIONS

Rabello Pump Station – Alternative 1	Cropley Station – Alternative 2	Mabury Road & North King Road – Alternative 3
Air Quality and Greenhouse Gas Emissions		
There appear to be no environmental constraints with regard to air quality or GHG emissions.	Air quality and GHG impacts would be greater than Alternative 1 due to the increased intensity of construction associated with the pipeline. Significant regional air quality impacts during construction are possible due to the length of pipeline construction depending on the amount of construction equipment and truck trips that would be required, and the project schedule.	Air quality and GHG impacts would be similar, but lessened, than Alternative 2.
Geology, Soils, and Seismicity		
The site is not located within any fault zones or earthquake induced landslide zones. The project site is located within a liquefaction zone on former marsh lands. Construction of the Variant 1 pipeline within the adjacent landfill slope would require geotechnical engineering and coordination with the landfill owner (the City of Santa Clara).	The site is not located within any fault or landslide zones. A portion of the pipeline in located within a liquefaction zone.	The tank location and pipeline alignment is located within a liquefaction zone.
Hydrology and Water Quality		
There appear to be no fatal flaws with regard to adverse impacts to water quality. Implementation of construction stormwater BMPs would be needed to avoid potential effects of runoff on the adjacent drainage channel/wetland area.	Similar to Alternative 1. The site is located adjacent to Berryessa Creek, which is channelized and separated from the site with an elevated berm, which should reduce the potential for stormwater runoff to the creek.	Similar to Alternative 2, adjacent to Penitentia Creek.
Hazards and Hazardous Materials		
Rabello site is adjacent to the All Purpose Landfill. The proposed Variant 1 interconnection pipeline would be located in the vicinity of the landfill’s three leachate extraction sumps. The Variant 1 pipeline construction could interfere with the landfill liner and leachate extraction system, and encounter contaminated materials in soil. Variant 2 would avoid these landfill systems but could encounter landfill-related contaminants during construction.	Moderate to high likelihood of encountering hazardous materials (petroleum hydrocarbons VOCs) in soil and/or groundwater near remediation sites in the vicinity of Berryessa Road and the Bayshore Freeway. Potential to encounter residual petroleum hydrocarbons near former LUST sites.	Potential to encounter petroleum hydrocarbons and VOCs near open and closed LUST sites.
Cultural Resources		
Historic Architectural Resources: No impact Prehistoric Archaeological Resources: None identified within the project site; moderate potential based on the number of archaeological sites in the vicinity. Historic-Era Archaeological Resources: Low potential to encounter. Paleontological Resources: Low potential to encounter.	Same as Alternative 1.	Same as Alternative 1.

TABLE 1 (Continued)
ENVIRONMENTAL CONSTRAINTS ANALYSIS SUMMARY FOR ALTERNATIVE TANK OPTIONS

Rabello Pump Station – Alternative 1	Cropley Station – Alternative 2	Mabury Road & North King Road – Alternative 3
Biological Resources		
Trees: There are no trees present in the construction zone of this site. Small trees are present on the south side of this site which should be avoided during Variant 1 pipeline installation, if feasible.	**Trees:** There are no trees present in the construction zone of this site. Trees are present on the perimeter of this site which should not need removal.	**Trees:** Three northern California black walnut trees (*Juglans hindsii*) are located in the middle of the site but approximately 50feet from the proposed water tank location. Tree removal would require a Live Tree Removal Application and public hearing/public noticing. Note that these trees are believed to be relics of previous hybrid orchard stock and these trees are not listed on the City of San Jose list of Heritage trees. There are also a number of trees on the perimeter of this site which should not need to be removed.
Potentially Jurisdictional Waters: There are no jurisdictional waters in the area of proposed tank location, however a potentially jurisdictional wetland is located south of the fenceline. Federal and state jurisdictional waters are adjacent to the north side (marsh/slough) and east side (lake/pond) of the proposed site.	**Potentially Jurisdictional Waters:** There are no jurisdictional waters in the area of proposed construction. Federal and state jurisdictional waters are adjacent to the south side of the proposed site in Berryessa Creek.	**Potentially Jurisdictional Waters:** There are no jurisdictional waters in the area of proposed construction. Federal and state jurisdictional waters are adjacent to the south side of the proposed site in Penitencia Creek.
Sensitive Habitat: There are no sensitive habitats in the area of proposed construction. Marsh / wetland habitat is on the north and east sides and Construction Stormwater Best Management Practices (BMPs) should be implemented to prevent water or sediment discharge into these areas. The proposed Variant 1 interconnection pipeline runs south though the fenced area where a patch of cattail (*Typha latifolia*) is present. This feature should be avoided if practical, as it may indicate potential jurisdictional wetland habitat. The presence of moisture in this area may possibly be from landfill runoff or an existing pipeline leak.	**Sensitive Habitat:** There are no sensitive habitats in the area of proposed construction. There is a 4 foot berm between the site and Berryessa Creek to the south which serves as a discharge/runoff barrier.	**Sensitive Habitat:** There are no sensitive habitats in the area of proposed construction. There is a 3 foot berm between the proposed site and Penitencia Creek to the north which serves as a discharge/runoff barrier.
Wildlife: Construction noise Impacts to nesting birds both on and adjacent to the site (i.e. in the adjacent wetland) is possible but considered a low probability. Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are recommended. Monitoring of nesting success during construction may be needed depending on preconstruction survey outcomes and subject to CDFW consultation, and which would benefit from characterization of construction noise compared to the ambient noise environment.	**Wildlife:** Impact to nesting bird populations is possible but considered a low probability. Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are recommended. Monitoring may needed depending on preconstruction survey outcomes.	**Wildlife:** Impact to nesting bird populations is possible but considered a low probability. Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are suggested. Monitoring may needed depending on preconstruction survey outcomes.
Plants: Due to the ruderal nature of this site no rare plant surveys are recommended.	**Plants:** Due to the ruderal nature of this site no rare plant surveys are recommended.	**Plants:** Due to the ruderal nature of this site no rare plant surveys are recommended.

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ATTACHMENT 1

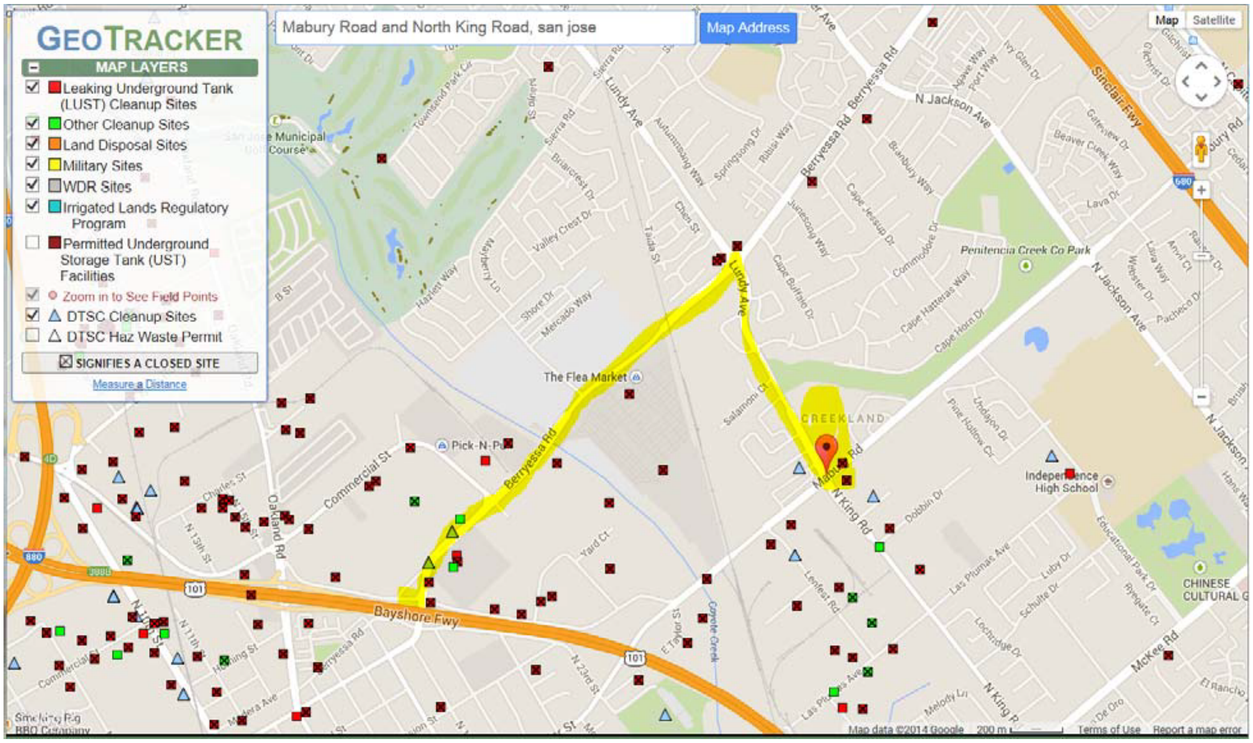
Hazardous Materials Sites in Project Vicinity

The potential to encounter hazardous materials in soil or groundwater during construction excavations is based upon review of a regulatory agency database search on the State Water Resources Control Board Geotracker website. The Geotracker website identifies the following types of environmental cases: leaking underground storage tank (LUST) sites; land disposal sites; military sites; California Department of Toxic Substances Control (DTSC) cleanup sites; other cleanup sites; permitted underground storage tank (UST) facilities; and permitted hazardous waste generators. The following three figures depict the known hazardous materials sites near the proposed sites and pipeline alignments.

Mabury & King Road

As shown on the figure below, there are a number of closed LUST sites near the intersections of Mabury and North King Road, and Lundy Avenue and Berryessa Road. Case closure indicates that potential hazardous materials impacts related to residual fuel contamination in soil and/or groundwater is low. If dewatering is required for pipeline excavation, groundwater could contain low levels of petroleum hydrocarbons and its constituents.

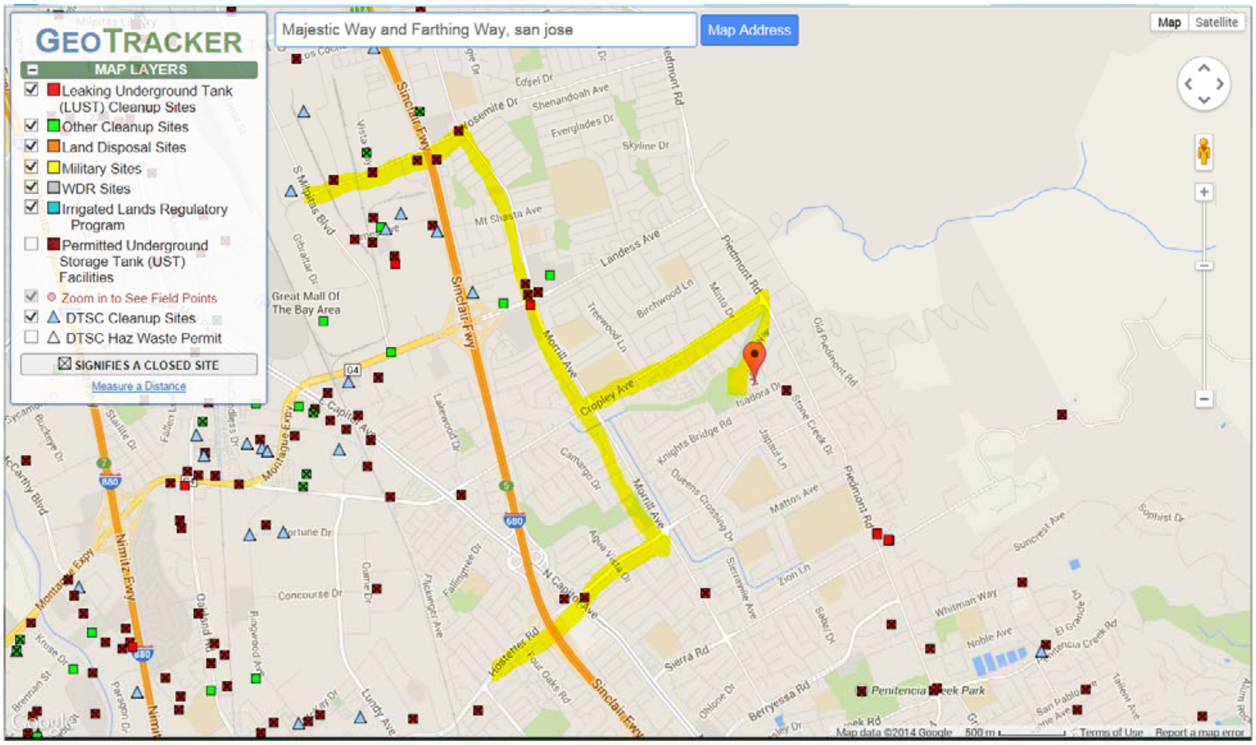
Near the southern end of Berryessa Road near the Bayshore Freeway, there are several open remediation sites with ongoing investigation and cleanup. These include the Clean Harbors hazardous waste storage and treatment facility, Chevron San Jose Berryessa Fuel Terminal, Solvent Services, and Abbott Oil. Construction in this vicinity is moderately likely to encounter contaminated soil or groundwater that could require appropriate offsite disposal.



NOTE: The proposed pipeline alignment is highlighted in yellow; the proposed storage tank location is within the yard highlighted adjacent to the marker.

Cropley Avenue

The figure below shows nine closed UST cases along the proposed pipeline alignment. There are two open cases near the intersection of Landess Avenue and Morrill Avenue: the Park Town Plaza dry cleaners and a Unocal Service Station. There is some potential to encounter petroleum hydrocarbons and volatile organic compounds (VOCs) in groundwater in this area.


GEOTRACKER
MAP LAYERS
☑ Leaking Underground Tank (LUST) Cleanup Sites
☑ Other Cleanup Sites
☑ Land Disposal Sites
☑ Military Sites
☑ WDR Sites
☑ Irrigated Lands Regulatory Program
☐ Permitted Underground Storage Tank (UST) Facilities
☑ Zoom in to See Field Points
☑ △ DTSC Cleanup Sites
☐ △ DTSC Haz Waste Permit
☒ SIGNIFIES A CLOSED SITE
Measure a Distance
Majestic Way and Farthing Way, san jose
Map Address
Map
Satellite
Sinclair Fwy
Cropley Ave
Morrill Ave
Landess Ave
Piedmont Rd
Great Mall Of The Bay Area
Map data ©2014 Google
500 m
Terms of Use
Report a map error

NOTE: The proposed pipeline alignment is highlighted in yellow; the proposed storage tank location is indicated by the marker.

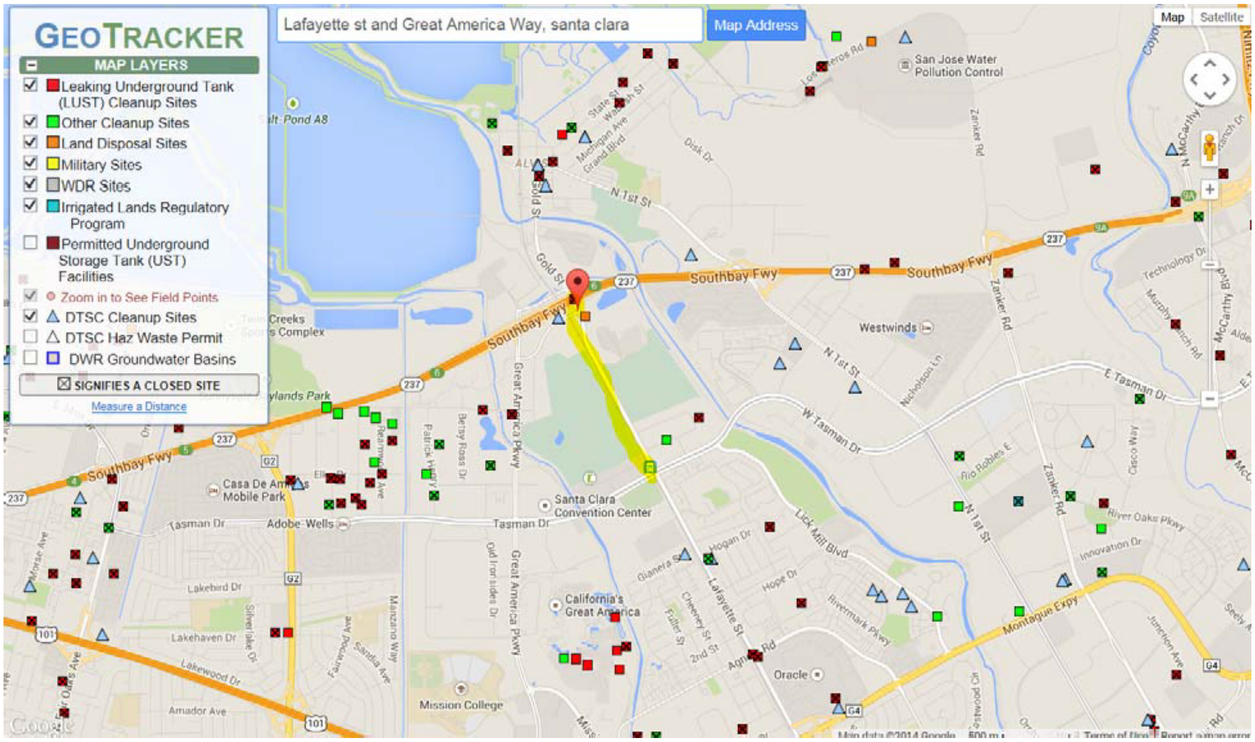
Rabello Pump Station

The GeoTracker data shows a closed UST case at the project site. The case is for the San Jose Pump Station located at 3519 Gold Street, based upon the removal of a 500 to 1,000-gallon UST in 1991. Case closure was granted on July 3, 2000. It appears that this icon is incorrectly located on the GeoTracker map and the actual site location is northeast of Highway 237.

The Rabello Pump Station is located adjacent to the north of "Parcel 1-NW" of the closed Santa Clara All Purpose Landfill. The 136 acre landfill occupies the area east of Lafayette Street and south to near Calle Del Mundo, and west of Lafayette Street to San Tomas Aquino Creek. Portions of the landfill have been converted to a public golf course and the remainder is open space. As reported in the First Semiannual 2014 Self-Monitoring Program Report (Golder Associates, July 2014), required in compliance with the Discharge Monitoring Program contained in Waste Discharge Requirements Order No. R2-2002-0008 groundwater beneath a portion of the landfill contains low levels of volatile organic compounds. Parcel 1-NW of the landfill was developed with a clay liner and leachate collection and removal system. Three leachate extraction sumps are in place at the base of Parcel 1-NW, adjacent to the Rabello Pump Station. Groundwater sampling in a perimeter well to the east of these sumps (and south of the stormwater retention basin) has detected the presence of chloroform.

The Rabello Variant 1 interconnection pipeline is proposed to the south of the Rabello site, on the landfill slope, and may be located in the vicinity of the landfill leachate extraction sumps. Any construction in this vicinity would require close coordination with the City of Santa Clara to avoid damage to the clay liner or leachate extraction system. In addition, the potential to encounter hazardous materials during excavation is considered moderate to high, and would likely require an appropriate health and safety plan and soil/groundwater management plan.

The Rabello Variant 2 pipeline alignment in Lafayette Street to Tasman Drive would be located between the two portions of the All Purpose Landfill. Subsurface excavation could encounter some landfill-related contamination. One open remediation site is located about 1,000 feet east of Lafayette Street, at 2301 Calle del Luna. According to an available status report, groundwater at the site (located 7 to 12 feet below ground surface) is contaminated with halogenated volatile organic compounds (HVOCs) likely associated with the use of chlorinated cleaning solvents. The HVOC plume appears to be contained onsite (Treadwell & Rollo, 2010).


GEOTRACKER
MAP LAYERS
☑ 🟥 Leaking Underground Tank (LUST) Cleanup Sites
☑ 🟩 Other Cleanup Sites
☑ 🟧 Land Disposal Sites
☑ 🟨 Military Sites
☑ ⬜ WDR Sites
☑ 🟦 Irrigated Lands Regulatory Program
☐ 🟥 Permitted Underground Storage Tank (UST) Facilities
☑ Zoom in to See Field Points
☑ △ DTSC Cleanup Sites
☐ △ DTSC Haz Waste Permit
☐ □ DWR Groundwater Basins
☒ SIGNIFIES A CLOSED SITE
Measure a Distance
Lafayette st and Great America Way, santa clara
Map Address
Map
Satellite
San Jose Water Pollution Control
Southbay Fwy
N 1st St
Gold St
Great America Pkwy
Santa Clara Convention Center
California's Great America
Lafayette St
Tasman Dr
Westwinds
Zanker Rd
Montague Expy
Mission College
Oracle
Lick Mill Blvd
Casa De Amigos Mobile Park
Lakehaven Dr
Lakewood Dr
Amador Ave
237
101
G2
G4
Google

NOTE: Proposed pipeline alignment (Variant 2) is highlighted in yellow; the proposed storage tank location is indicated by the marker.

References

Golder Associates Inc., 2014. City of Santa Clara All Purpose Landfill, First Semiannual 2014 Self-Monitoring Program Report. July 2014.

SWRCB Geotracker, 2014. Available at http://geotracker.waterboards.ca.gov/

Treadwell & Rollo, 2010. Five Year Status Report, 2301 Calle de Luna, Santa Clara, California. January 7, 2010.

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ATTACHMENT 2

Cultural Resources Constraints Analysis

ESA

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memorandum

date October 6, 2014

to Julie Moore, ESA Water

from Heidi Koenig, ESA Cultural Resources

subject Cultural Resources Constraints Analysis for the South Bay Water Recycling Storage Tank Sites

Statement of Confidentiality

This memorandum contains confidential cultural resources location information; distribution should be restricted to those with a need to know. Cultural resources are nonrenewable, and their scientific, cultural, and aesthetic values can be significantly impaired by disturbance. To deter vandalism, artifact hunting, and other activities that can damage cultural resources, the locations of cultural resources should be kept confidential. The legal authority to restrict cultural resources information is in California Government Code Section 6254.10 and the National Historic Preservation Act of 1966, as amended, Section 304.

Introduction

Environmental Science Associates (ESA) has prepared this Cultural Resources Constraints Analysis for the South Bay Water Recycling (SBWR) Project Strategic and Master Planning Zone 1 Storage Tank Siting Study. This memorandum documents the methods and findings of the cultural resources background research and survey conducted for three proposed tank options and associated pipeline alignments.

This memorandum provides an assessment of potential impacts on cultural and paleontological resources that might be present in the vicinity of the three proposed project options. Cultural resources are defined as:

1) ***Historic architectural resources*** including buildings, structures (i.e. bridges), objects, and historic districts.

2) ***Prehistoric archaeological resources*** relating to Native American sites. Materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs). Human remains may also be associated with prehistoric sites.

3) ***Historic-era archaeological resources*** relating to the Spanish, Mexican, or early American periods. Materials might include stone, concrete, or adobe footings and walls; artifact filled wells or privies; and deposits of metal, glass, and/or ceramic refuse.

4) ***Paleontological resources*** include fossilized remains of vertebrate and invertebrate organisms, fossil tracks and trackways, and plant fossils.

ESA archaeologist Heidi Koenig, M.A. completed this study. Ms. Koenig is a Registered Professional Archaeologist (RPA) and has conducted archaeological research in California for more than 13 years. She meets the Secretary of the Interior's Professional Qualification Standards for archaeologist. Matthew Russell PhD., RPA, who meets the Secretary of the Interior's Professional Qualification Standards for archaeologist, reviewed the report and provided quality assurance.

Background Research

ESA completed a records search for the proposed project at the Northwest Information Center (NWIC) of the California Historical Resources Information System on September 16, 2014 (File No. 14-0342). The purpose of the records search was to (1) determine whether known cultural resources have been recorded within or adjacent to the proposed tank options and pipeline alignments; (2) assess the likelihood for unrecorded cultural resources to be present based on historical references and the distribution of nearby sites; and (3) develop a context for the identification and preliminary evaluation of cultural resources. The records search consisted of an examination of the following documents:

- **NWIC base maps** (USGS Milpitas, San Jose West, San Jose East, and Calaveras Reservoir 7.5-minute topographic maps), to identify recorded archaeological sites and studies within a 1-mile radius of the project options.
- **NWIC base maps** (USGS Milpitas, San Jose West, San Jose East, and Calaveras Reservoir 7.5-minute topographic maps), to identify recorded historic-period resources of the built environment (building, structures, and objects) within a ¼-mile radius of the project options.
- **Resource Inventories**: *California Inventory of Historical Resources, California Historical Landmarks, Historic Properties Directory for Santa Clara County* (through April 2012).
- **Prehistoric Archaeology:** T.L. Jones and K.A. Klar (2007), *Prehistoric California: Colonization, Culture, and Complexity*; Michael J. Moratto (1984), *California Archaeology*.
- **Historic Maps:** An extensive on-line historic map collection with over 300 maps and views of California and Santa Clara County is available online at http://davidrumsey.com; Thompson and West (1876), *Historical Atlas Map of Santa Clara County, California*.
- **Environment:** Helley, E.J., LaJoie, K.R. (1979), *Flatland Deposits of the San Francisco Bay Region, California;* Jack Meyer and Jeffrey Rosenthal (2007), *Geoarchaeological Overview of the Nine Bay Area Counties in Caltrans District 4.*

Geologic Context

The California coast has undergone dramatic landscape changes since humans began to inhabit the region more than 10,000 years ago. Rising sea levels and increased sedimentation into streams and rivers are among some of the changes.[1] In many places, the interface between older land surfaces and Holocene-age landforms are marked by a well-developed buried soil profile, or a paleosol. Paleosols preserve the composition and character of the earth's surface prior to subsequent sediment deposition; thus, paleosols have the potential to preserve archaeological resources if the area was occupied or settled by humans. Because human populations have grown throughout the Holocene, archaeological sites are predicted to be more frequent in paleosols identified in Late Holocene contexts. Conversely, lower population levels during the early Holocene suggest a significantly less likely occurrence of archaeological resources in older paleosols (early Holocene or Pleistocene). Other criteria used to measure the archaeological sensitivity of a given area include:

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[1] Helley, E.J., LaJoie, K.R., *Flatland Deposits of the San Francisco Bay Region, California.* U.S. Geological Survey Professional Paper 943. 1979.

1) That archaeological sites tend to be located near perennial water sources;

2) That archaeological deposits from successive time periods are more common because the density of human populations increased over time; and

3) That the longer a landform remained at the surface, the greater the probability that any one spot on that landform was occupied.

The project vicinity is in an area mapped as Holocene-age Alluvium, which coupled with the many buried archaeological sites found in the Santa Clara Valley, has a very high potential to contain buried paleosols and associated archaeological materials and/or human remains. Deeply buried sites have been uncovered in the Santa Clara Valley, at depths varying between 1 foot and more than 10 feet below the ground surface. In fact, more than 60 percent of recorded archaeological sites in this region have been found in a buried context.[2]

Conversely, Holocene-age Alluvium has a low potential to contain paleontological resources. This type of geologic deposit is too young (i.e., less than 10,000 years old) to have fossilized the remains of organisms, or to have preserved vertebrate fossils.[3] No paleontological resources have been identified in Santa Clara County from the geologic units present in the project vicinity.[4]

Expected Cultural Resource Types

Historic-era architectural resources: Two historic-era bridges have been identified in the proposed Mabury pipeline alignment; both bridges have been previously evaluated as Category 5 bridges in the Caltrans Historic Bridge Inventory indicating they are not eligible for listing in the National Register of Historic Places. No further consideration of these bridges is necessary. No additional historic architectural resources are located in the proposed tank options and pipeline alignments.

Prehistoric archaeological resources containing fire-affected rock, shell or bone faunal remains, baked clay objects, midden soils, ground or pecked stone tools, and/or flaked-stone tools and debitage may be encountered in a subsurface context, possibly with no indication of the site visible on the ground surface. Human burials are also possible in such sites.

Historic-era archaeological resources are unlikely to be in the proposed tank options and pipeline alignments based on a review of historic maps. In the general vicinity historic-era archaeological sites would most likely be related to American-period settlement and farming activities. Such resources include buried foundations, privies, trash dumps, early fences and irrigation features, or isolated glass, metal, or ceramic artifacts.

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[2] Meyer, Jack, and Jeffrey Rosenthal, *Geoarchaeological Overview of the Nine Bay Area Counties in Caltrans District 4.* Prepared for Caltrans District 4. 2007.

[3] Society of Vertebrate Paleontology (SVP). *Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Guidelines*, Society of Vertebrate Paleontology News Bulletin, Vol. 163, p. 22-27. 1995.

[4] University of California Museum of Paleontology (UCMP), Online Specimens Database Search. Accessed at http://ucmpdb.berkeley.edu/cgi/ucmp_query2. October, 2014.

Paleontological resources are unlikely to be in the proposed tank options and pipeline alignments. The Society of Vertebrate Paleontology (SVP) has established guidelines for the identification, assessment, and mitigation of adverse impacts on nonrenewable paleontological resources. Geologic units of *low* paleontological potential are those that are not known to have produced a substantial body of significant paleontological material, including Holocene-age alluvium, as discussed above in the Geologic Context.

Field Methods

ESA conducted a field survey of the proposed tank site options and associated pipeline alignments on September 22, 2014. No cultural resources were identified during the field survey. Given the degree of previous disturbance within the project vicinity and the typical subsurface geoarchaeological context of known resources in the vicinity, this negative result is not surprising.

Results

The records search indicated that numerous cultural resources studies have been completed within the vicinity of the tank site options and pipeline alignments. Studies include literature searches, site specific inventories, archaeological data recovery excavations, and regional overviews. Thirteen prehistoric archaeological resources, two historic-era ranch complexes, and two historic-era bridges have been recorded within a 1-mile radius of the project components. **Table 1** lists the previously recorded resources by tank site and associated pipeline alignment as well as the results of the survey effort.

Summary and Constraints

There is no potential to impact historic architectural resources. There are no historic architectural resources in the proposed tank sites and pipeline alignment options. The two bridges located in the Mabury pipeline alignment have been previous evaluated as not eligible for listing in the National Register of Historic Places and no further consideration is required.

There is a moderate potential to impact prehistoric archaeological resources. Recorded prehistoric archaeological resources have been identified within the records search radius of all three tank sites and pipeline alignment options. While no known sites have been previously identified on the surface at the tank sites or along the pipeline alignments, there remains a moderate potential for unknown sites to be buried or otherwise obscured (i.e. paved or built over), based on the location and number of archaeological sites previously identified; the results of the current survey effort and previous investigations in the vicinity; and the existing conditions of the tank sites and pipeline alignments. However, due to previous disturbance from existing facilities and infrastructure, the potential is lessened.

There is a low potential to impact historic-era archaeological resources based on a review of historic maps and the existing conditions of the tanks options and pipeline alignments.

There is a low potential to impact paleontological resources based on the geologic context and the SVP standards.

TABLE 1
RESULTS OF BACKGROUND RESEARCH AND SURVEY EFFORT

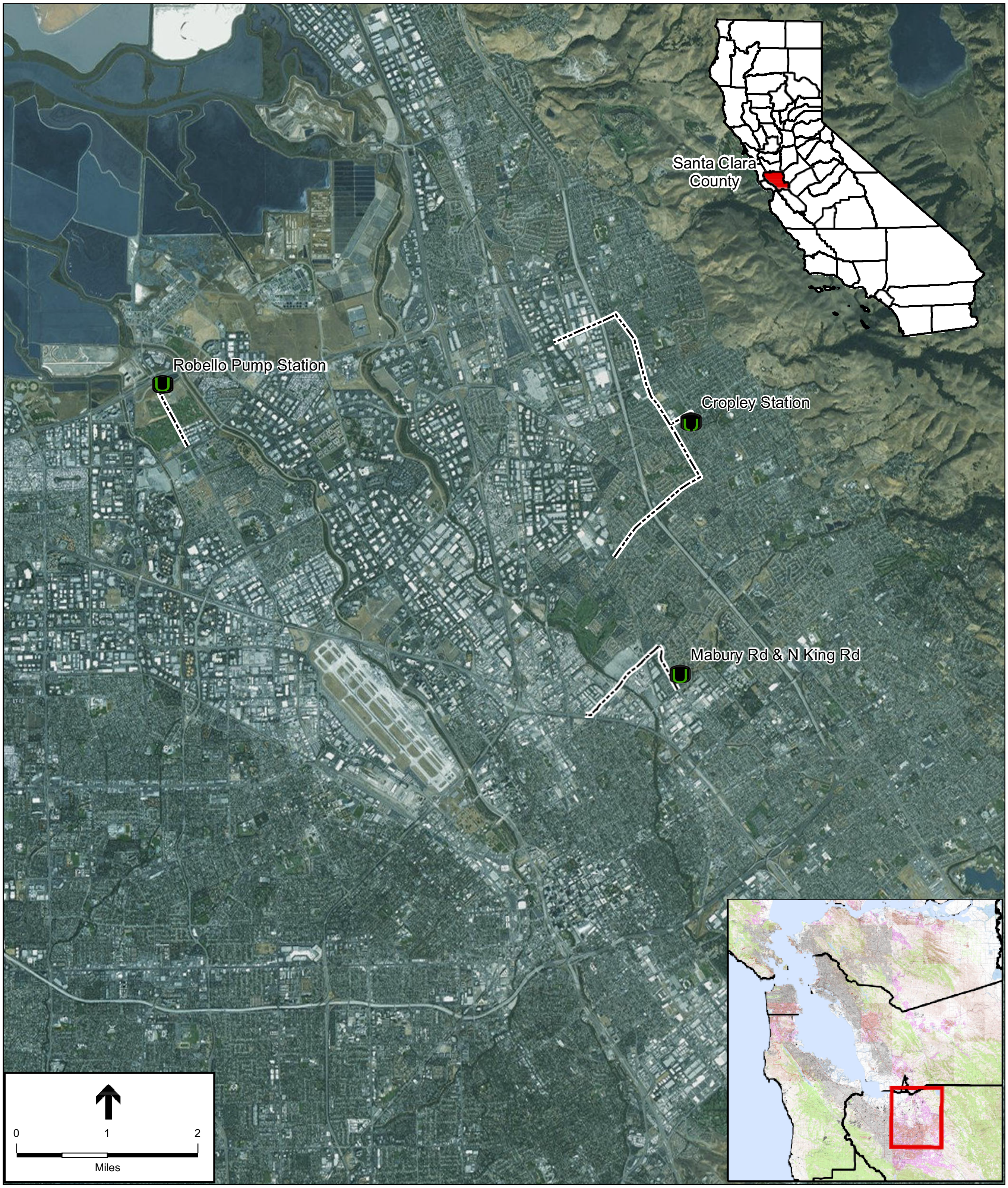
Primary No.	Trinomial	Type	Description	Recorded by / Date	Distance from Project Component
Rabello Station and Pipeline					
P-43-000025	CA-SCL-5	Prehistoric	Shellmound	Loud / 1912 Far Western / 2012	1,000 feet east of Rabello Tank
P-43-000026	CA-SCL-6	Prehistoric	Extensive midden deposit with artifacts and human remains	Morris / 1980	1,800 feet east of Rabello Tank Alignment
P-43-000277	CA-SCL-268	Prehistoric	Midden with shell and chert debitage	ARCS / 1976	2,000 feet east of Rabello Tank Alignment
P-43-000448	CA-SCL-447	Prehistoric	Shell and bone fragments	Chavez / 1980	2,700 feet east of Rabello Tank Alignment
P-43-000486	CA-SCL-485	Prehistoric	Bowl mortar and fire cracked rock in ditch	ARM / 1982	2,700 feet northeast of Rabello Tank
Survey Results		The Rabello tank site consists of a 49,000 square-foot (1.12 acre) plot highly disturbed from previous construction of an existing pump station, pipelines, and other infrastructure. At the time of survey the location was used for staging. Surface visibility was good (approximately 80 percent); however, all visible soil was imported gravel and artificial fill. The proposed pipeline for the Rabello tank site would extend south along Lafayette Street for approximately 4,000 feet to the intersection with West Tasman Drive. All roads are paved. No cultural resources or other evidence of past human use or occupation was identified during the survey effort. The nearest prehistoric site is 1,000 feet east of the tank site on the west bank of the now channelized Guadalupe River. The other archaeological sites in the vicinity are also adjacent to the Guadalupe River bank.			
Cropley Station and Pipeline					
P-43-000168	CA-SCL-156	Prehistoric	Lithic scatter	Bergthold / 1974	3,900 feet northeast of Cropley Station Alignment
P-43-000169	CA-SCL-157	Prehistoric	Isolate artifact	Anderson / 1974	1,600 feet northeast of Cropley Station Alignment
P-43-000576	CA-SCL-581	Prehistoric	43 human burials with associated artifacts	Holman / 1984; Anastasio / 1988; Cambra, Ananian, Leventhal / 1990; James / 1987	1,500 feet west of Cropley Station Alignment
P-43-000588	CA-SCL-593	Prehistoric	Shell midden with chert flakes	ARM / 1986	3,000 feet west of Cropley Station Alignment
P-43-001136	---	Prehistoric	Reburial of human remains	ARM / 1999	2,900 feet northeast of Cropley Station Alignment
Survey Results		The Cropley Station tank site consists of a 125,200 square-foot (2.85 acre) triangular plot disturbed from existing uses including a well, tank, and other infrastructure. Visibility in the undeveloped portions of the site was low due to heavy vegetation and abundant wood chips. Channelized Berryessa Creek borders the site on the north; an existing 4-foot-high berm separates the plot from the creek. The proposed pipeline segment for the Cropley Station tank would extend along a short access road (550 feet) to Cropley Avenue and continue west on Cropley Avenue for 1,400 feet to Morrill Road, crossing Berryessa Creek. The pipeline would continue north on Morrill Road for 7,300 feet to Landess Avenue and south on Morrill Road for 3,500 feet to Hostetter Road. On Hostetter Road the pipeline would continue west for 6,900 feet. On Landess Avenue the pipeline would continue west and cross under I-680 to Montague Expressway for 3,900 feet. All roads are paved. No cultural resources or other evidence of past human use or occupation was identified during the survey effort. The nearest prehistoric resource is an isolated artifact identified 1,600 feet to the northeast. Two additional prehistoric sites have been identified along Berryessa Creek. One site has been identified on channelized Piedmont Creek.			

TABLE 1 (Continued)
RESULTS OF BACKGROUND RESEARCH AND SURVEY EFFORT

Primary No.	Trinomial	Type	Description	Recorded by / Date	Distance from Project Component
Mabury Station and Pipeline					
P-43-000349	CA-SCL-343	Prehistoric	Shell mound, hundreds of burials reported	Skeer / 1978	4,600 feet northwest of Mabury Station Alignment
P-43-000473	CA-SCL-472H	Historic	Former 1856 ranch complex	ARM / 1981	5,900 feet northwest of Mabury Station Alignment
P-43-000576	CA-SCL-581	Prehistoric	43 human burials with associated artifacts	Holman / 1984; Anastasio / 1988; Cambra, Ananian, Leventhal / 1990; James / 1987	6,000 feet northwest of Mabury Station Alignment
P-43-000621	CA-SCL-627	Prehistoric	Two human burials, artifacts, faunal and shell	Farnsworth / 1987	3,300 feet northwest of Mabury Station Alignment
P-43-000922	---	Historic	1971 Bridge (Category 5)	Laffey / 1994	Within Mabury Station Alignment
P-43-001010	CA-SCL-438H	Historic	Former pre-1895 ranch complex	ARM / 1981	1,500 feet west of Mabury Station Alignment
P-43-001083	CA-SCL-705	Prehistoric	One human burial	Fong / 1990	4,300 feet northwest of Mabury Station Alignment
---	---	Historic	Bridge 37C0546 – 1923 (Category 5)	Caltrans / 2010	Within Mabury Station Alignment
Survey Results		The Mabury Station tank site consists of a 139,100 square-foot (3.2 acre) triangular plot highly disturbed from existing uses, including staging and stockpiles, as well as a well, tank, and other infrastructure. Channelized Penitencia Creek borders the site on the north; an existing 4-foot-high berm separates the plot from the creek. Two northern California black walnut trees are in the center of the site. Soil consisted primarily of artificially deposited fill and gravels. Heavy vegetation obscured visibility in the northwestern section of the parcel. Pipeline segments for the Mabury Station tank site would consist of a short segment along the access road (500 feet) to Mabury Road, where the pipeline would continue west for 425 feet to Lundy Avenue. The pipeline would extend north on Lundy Avenue for 2,700 feet crossing Penitencia Creek. At Berryessa Road the pipeline would continue southwest for 5,800 feet crossing Coyote Creek. All roads are paved. No cultural resources or other evidence of past human use or occupation was identified during the survey effort. The nearest prehistoric sites are located several thousand feet north of the pipeline alignment adjacent to Lundy Avenue. The pipeline alignments cross two historic-era bridges; both bridges have been evaluated as Category 5 in the Caltrans Historic Bridge Inventory, indicating they are not eligible for listing in the National Register of Historic Places.			

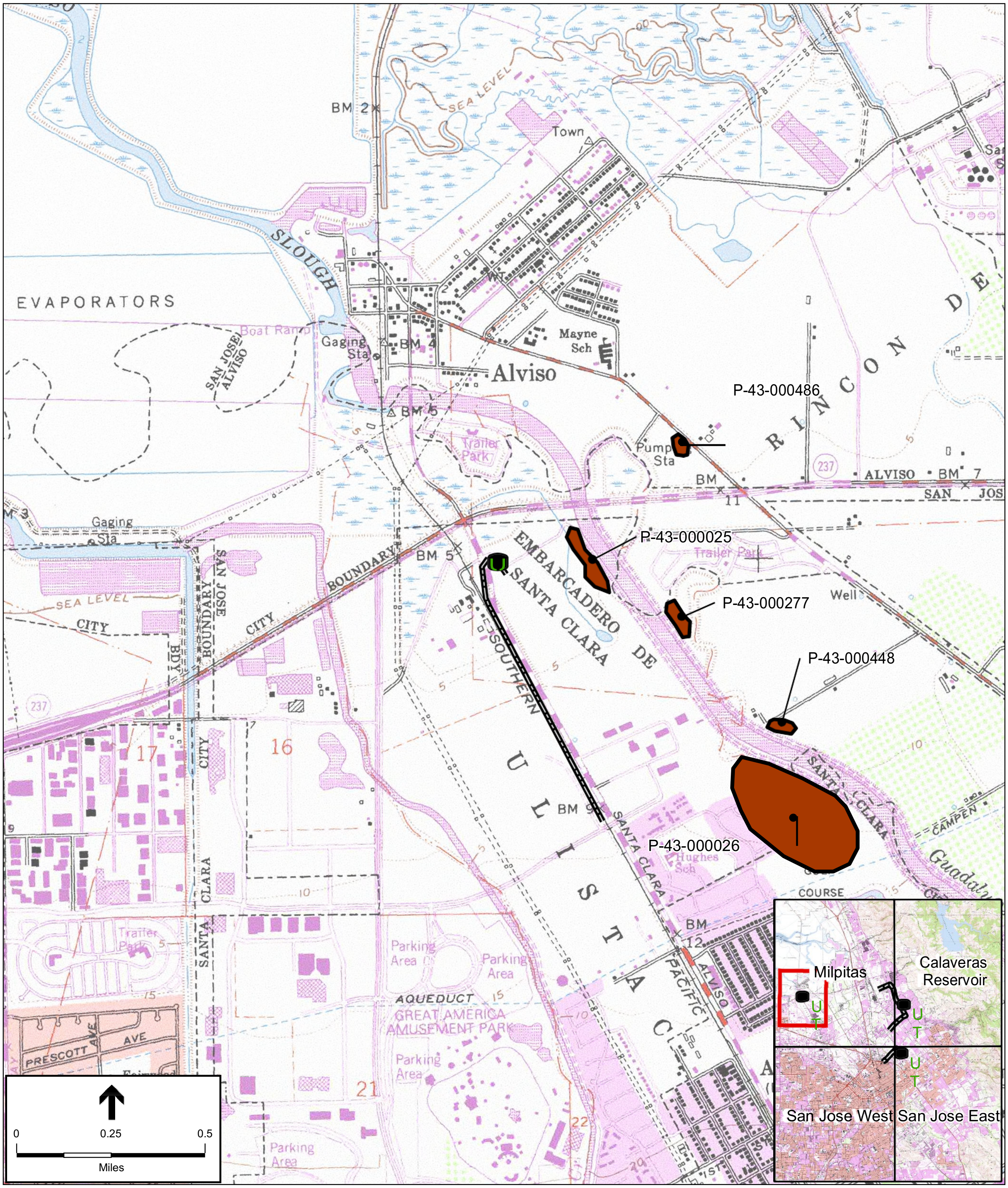
TABLE 2
CULTURAL CONSTRAINTS ANALYSIS SUMMARY FOR SBWR STORAGE TANK LOCATIONS

Rabello Station	Cropley Station	Mabury Station
Cultural Resources		
Historic architectural resources No potential. **Prehistoric archaeological resources** Five prehistoric archaeological resources have been recorded in the vicinity of the Rabello Station tank site. The tank site is approximately 1,000 feet from the nearest known archaeological site and the Guadalupe Creek channel. Based on the distance from Guadalupe Creek and the general archaeological sensitivity for buried sites in the Santa Clara Valley, this option has a moderate potential for uncovering previously unidentified prehistoric archaeological resources. **Historic-era archaeological resources** Based on a review of historic maps and the existing conditions, there is a low potential for uncovering historic-era archaeological resources for the Rabello Station option. **Paleontological resources** Based on the SVP standards and the geologic setting, there is a low potential to uncover paleontological resources.	**Historic architectural resources** No potential. **Prehistoric archaeological resources** Five prehistoric archaeological resources have been recorded in the vicinity of the Cropley Station tank site and associated pipeline alignment. The tank site is approximately 1,600 feet from the nearest known resource and is adjacent to the Berryessa Creek channel. The southern terminus of the pipeline alignment is 1,500 feet from a very large prehistoric site with human remains. Based on the distance from Berryessa Creek and the general archaeological sensitivity for buried sites in the Santa Clara Valley, this option has a moderate potential for uncovering previously unidentified prehistoric archaeological resources. **Historic-era archaeological resources** Based on a review of historic maps and the existing conditions, there is a low potential for uncovering historic-era archaeological resources for the Cropley Station option. **Paleontological resources** Based on the SVP standards and the geologic setting, there is a low potential to uncover paleontological resources.	**Historic architectural resources** Two historic-era bridges (both Category) are located along the pipeline alignment. No further consideration is necessary. No potential. **Prehistoric archaeological resources** Four prehistoric archaeological resources have been recorded in the vicinity of the Mabury Station tank site and associated pipeline alignment. The tank site itself is approximately 5,300 feet from the nearest known resource. The tank site is adjacent to the Penitencia Creek channel. Based on the distance from Penitencia Creek and the general archaeological sensitivity for buried sites in the Santa Clara Valley, the Mabury Station tank option has a moderate potential for uncovering previously unidentified prehistoric archaeological resources. **Historic-era archaeological resources** Two historic-era ranch complexes have been recorded in the vicinity. Based on a review of historic maps and the existing conditions, there is a low potential for uncovering historic-era archaeological resources for the Mabury Station option. **Paleontological resources** Based on the SVP standards and the geologic setting, there is a low potential to uncover paleontological resources.



SBWR Storage Tanks Project . 120337

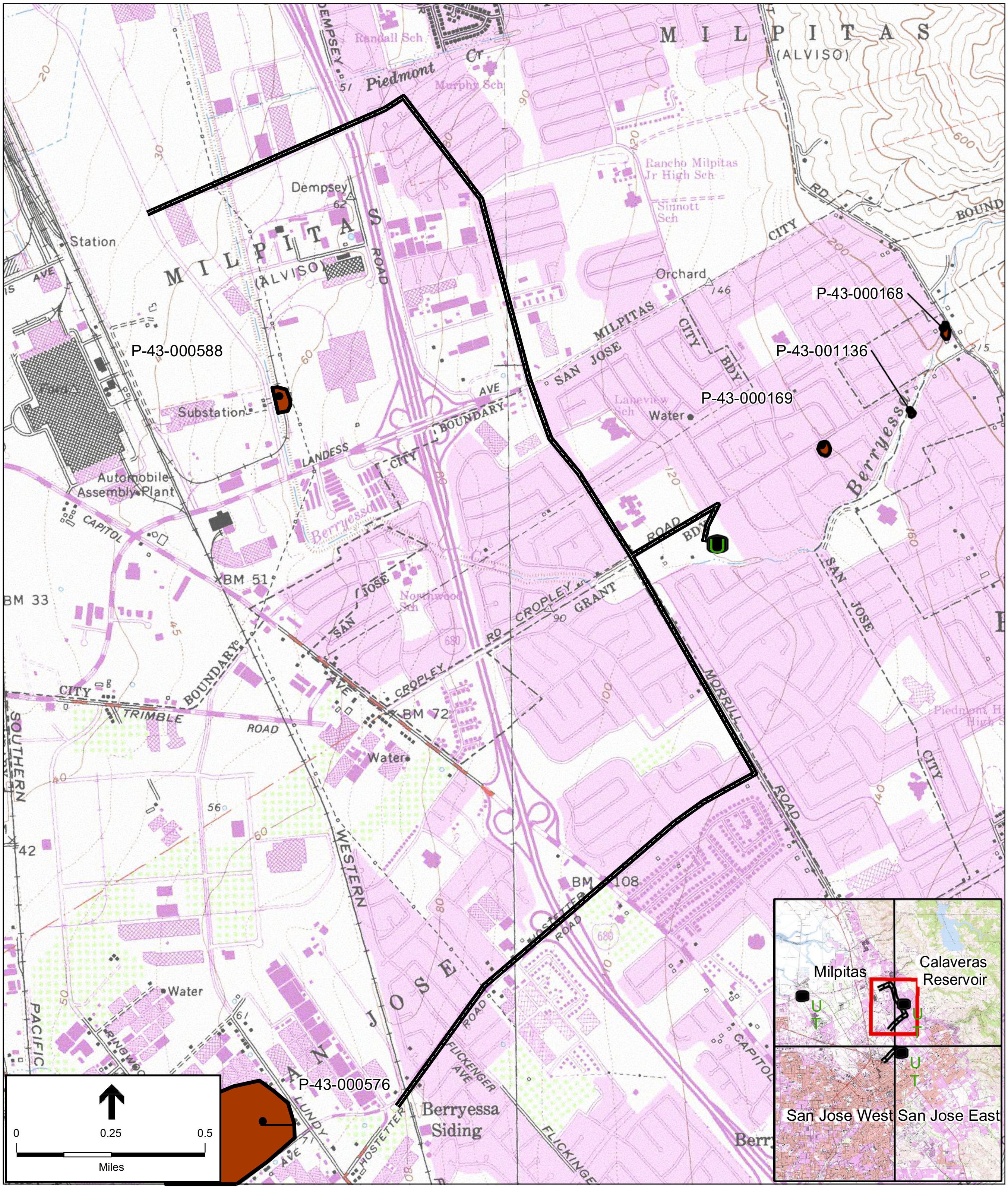
Figure 1
Project Vicinity



SBWR Storage Tanks Project . 120337

Figure 2a

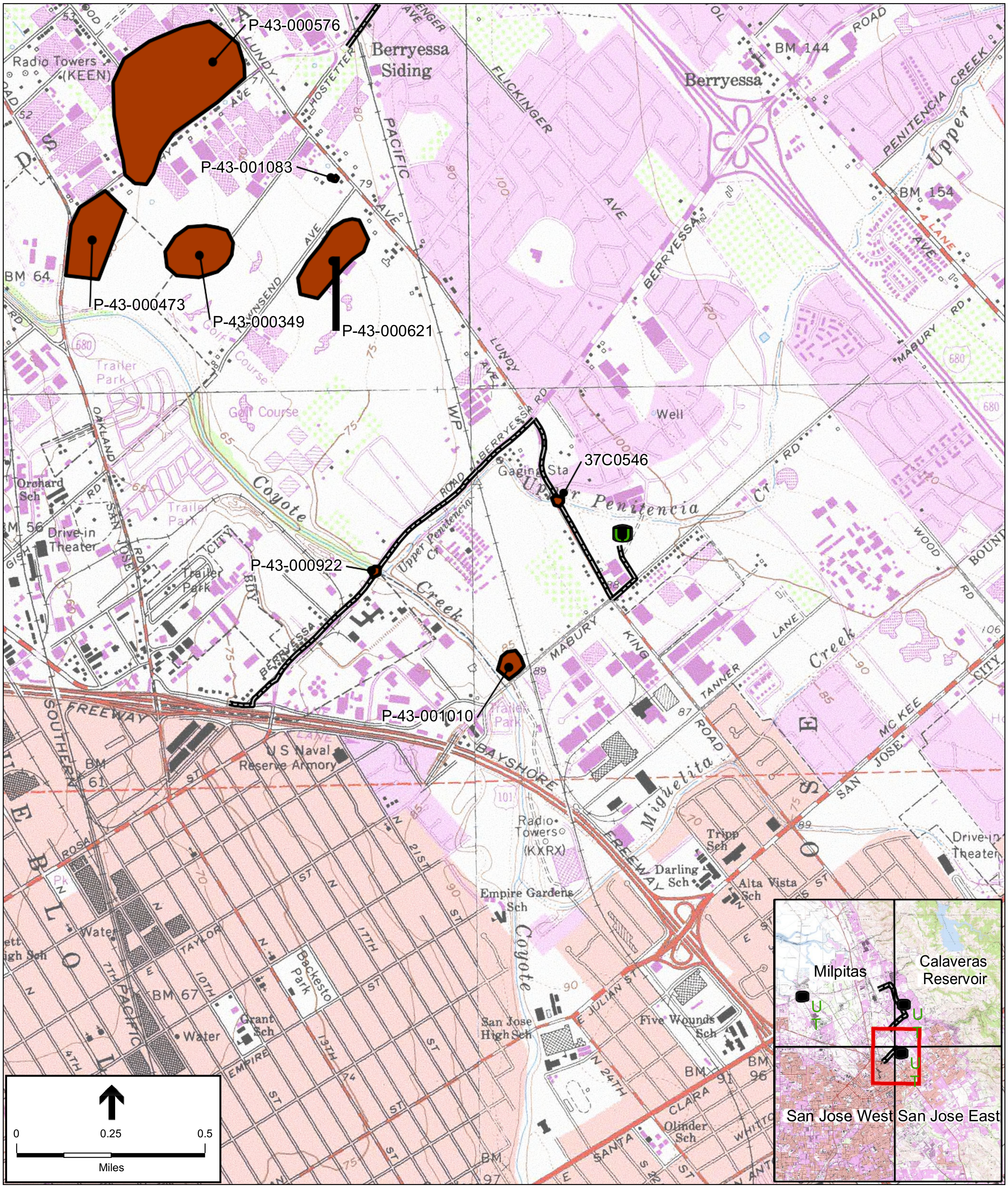
Project Location



SBWR Storage Tanks Project . 120337

Figure 2b

Project Location



SBWR Storage Tanks Project . 120337

Figure 2c

Project Location

ATTACHMENT 3

Biological Resources Constraints Analysis

ESA

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memorandum

date October 2, 2014

to Julie Moore

from David Rodriguez

subject Biological Constraints Associated with SWBR Storage Tank Sites

ESA evaluated potential biological resources concerns at the Zone 1 alternative tank sites. This assessment was accomplished by review of the California Natural Diversity Database (California Department of Fish and Wildlife, September 16, 2014) and a site visit by ESA biologist, David Rodriguez, on September 22, 2014 to observe existing conditions on the site and nearby vicinity.

Rabello Station

The Rabello Station tank site is a paved and gravel yard that extends from Lafayette Street on the west to the fenceline enclosing the pump station and detention pond to the east. The proposed placement of the storage tank is in the middle of this gravel-covered area. The site is currently being used as a construction staging area, occupied by a temporary office, storage containers, trucks and equipment. To the north, the site is bound by a wetland channel which currently has a two foot silt fence along its border. There also are straw wattles on the channel side of the silt fence. The south edge of the site is bordered by a fence with a small berm intervening between the site, the adjacent ditch and landfill, which slopes steeply upward to the south. A small patch of wetland vegetation (cattails) was observed at this location, which could be affected by the proposed pipeline interconnection alignment.

Summary of key issues:

- BMP (Best Management Practices) should be implemented to prevent water and sediment discharge into wetland areas to the north and east. Existing BMPs on the site may need to be improved.

- Pipeline routing should avoid cattails and trees on southern fence border, if feasible. Although this area of wetland vegetation is small and seems disconnected to nearby wetland features, wetland permitting could be required. A rough, preliminary estimate of this effort is approximately 3-12 months, and $15,000 to $50,000.

- Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are recommended.

- Due to the ruderal habitat no plant surveys are recommended.

Cropley Station

The Cropley site is located in a triangle plot nested within a residential area between Cropley Avenue, Parkrow Lane and Berryessa Creek. The site has previously been graded and covered in wood chips and is considered ruderal in nature.

The south side of the Cropley site is bound by Berryessa Creek which is considered Federal and state jurisdictional waters. There is an existing four foot berm in place between the proposed site and the Berryessa Creek.

Summary of key issues:

- A four foot berm exists between the site and Berryessa Creek. If this stays in place during tank construction, no further actions are needed to protect against discharge into the creek.
- Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are recommended.
- Due to the ruderal habitat, no plant surveys are recommended.

Mabury Station

The Mabury site is also located in a triangle plot nested within a residential area between Creekland Circle, North King Road and Penitencia Creek. The site is currently being used as a staging and storage area by a landscape contractor and is considered ruderal in nature.

The north side of the Mabury site is bound by Penitencia Creek which is considered federal and state jurisdictional waters. There is an existing three foot berm in place between the proposed site and Penitencia Creek.

Summary of key issues:

- A four foot berm exists between the site and Penitencia Creek. If this remains during construction, no further actions are necessary to protect against discharge into the creek.
- Avoiding the northern California black walnut trees in the center of the site is recommended. The current plan positions the storage tank approximately 50 feet from the nearest walnut tree. Tree removal would require a City of San Jose tree removal permit, which includes public noticing in the vicinity and a public hearing.
- Pre-construction surveys for nesting birds, no more than two weeks prior to the start of construction, are recommended.
- Due to the ruderal habitat, no plant surveys are recommended.

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Appendix 5A - Long Term NPR Cost Estimate

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RMC

Project: SBWR Strategic and Master Plan

Aspect: Long-Term NPR Cost Estimate

Estimate Type: Conceptual Design

Divisions	Long-Term NPR (Excluding Retrofit Costs)	Long-Term NPR (Including Retrofit Costs)
Pipelines	$108,000,000	$108,000,000
Storage Reservoir	$22,500,000	$22,500,000
Pump Stations	$11,310,000	$11,300,000
Retrofits	$0	$10,700,000
Raw Construction Cost	$141,810,000	$152,500,000
Construction Contingency	$28,400,000	$30,500,000
Base Construction Cost	$170,210,000	$183,000,000
Implementation Costs	$51,100,000	$54,900,000
Project Contingency	$22,100,000	$23,800,000
Total Estimated Capital Cost	**$243,410,000**	**$261,700,000**

Annual Costs

Annual O&M	$ 4,500,000	$ 4,500,000
Annual R&R Fund	$ 3,400,000	$ 3,700,000
Total Annual O&M	**$ 7,900,000**	**$ 8,200,000**

Cost of Water

Annualized Capital Costs	$ 12,400,000	$ 13,400,000
Total Annualized Cost	$ 20,300,000	$ 21,600,000
Yield, AFY	10,000	10,000
Cost of Water including R&R Fund	**$ 2,030**	**$ 2,160**
Cost of Water excluding R&R Fund	$ 1,690	$ 1,790

Notes: 1. Annualized cost are based on a 30 year life at 5.5%

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t: SBWR Strategic and Master Plan

onent: Long-Term NPR Cost Estimate

Date:	September 17, 2014
Project Number:	0057-007.02
Prepared by:	MN revised

pe: Conceptual Design

ost Summary by Division

sion	Subtotal	Notes
k	$ 108,000,000	
e	$ 22,500,000	
	$ 8,700,000	
nent	$ -	
nical	$ -	
cal	$ 1,740,000	
	$ 870,000	

RAW CONSTRUCTION COST		**$ 141,810,000**
Construction Contingency	20%	$ 28,362,000
BASE CONSTRUCTION COST		**$ 170,172,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 51,051,600
Easements		$ -
Project Contingency	10%	$ 22,122,360
TOTAL PROJECT COST		$ 243,345,960

sion	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
k							**$ 108,009,600**	
ater Company Expansions								
s							$ -	
	Alignment A	4	IN	3700	LF	$ 64.00	$ 236,800	
		6	IN	2600	LF	$ 96.00	$ 249,600	
		8	IN	16800	LF	$ 128.00	$ 2,150,400	
	Alignment D	6	IN	13400	LF	$ 96.00	$ 1,286,400	
		8	IN	29300	LF	$ 128.00	$ 3,750,400	
		24	IN	19200	LF	$ 384.00	$ 7,372,800	
	Alignment E	6	IN	34500	LF	$ 96.00	$ 3,312,000	
		8	IN	7700	LF	$ 128.00	$ 985,600	
		12	IN	10100	LF	$ 192.00	$ 1,939,200	
		30	IN	8600	LF	$ 480.00	$ 4,128,000	
	Alignment K	6	IN	10200	LF	$ 96.00	$ 979,200	
		8	IN	7700	LF	$ 128.00	$ 985,600	
	Alignment L	6	IN	18000	LF	$ 96.00	$ 1,728,000	
		8	IN	12800	LF	$ 128.00	$ 1,638,400	
		10	IN	12100	LF	$ 160.00	$ 1,936,000	
		12	IN	10500	LF	$ 192.00	$ 2,016,000	
	Alignment N	10	IN	8100	LF	$ 160.00	$ 1,296,000	
	Alignment Q	4	IN	37550	LF	$ 64.00	$ 2,403,200	
		6	IN	37550	LF	$ 96.00	$ 3,604,800	
		10	IN	27900	LF	$ 160.00	$ 4,464,000	
		12	IN	16100	LF	$ 192.00	$ 3,091,200	
		18	IN	15550	LF	$ 288.00	$ 4,478,400	
		24	IN	15550	LF	$ 384.00	$ 5,971,200	
	Alignment R	4	IN	2300	LF	$ 64.00	$ 147,200	
		6	IN	9300	LF	$ 96.00	$ 892,800	
		8	IN	2000	LF	$ 128.00	$ 256,000	
	Future Pipelines	6	IN	23000	LF	$ 96.00	$ 2,208,000	
		8	IN	38800	LF	$ 128.00	$ 4,966,400	
		12	IN	900	LF	$ 192.00	$ 172,800	
		16	IN	10200	LF	$ 256.00	$ 2,611,200	
		20	IN	20300	LF	$ 320.00	$ 6,496,000	
		30	IN	33300	LF	$ 480.00	$ 15,984,000	
		30	IN	16400	LF	$ 480.00	$ 7,872,000	
	Milpitas GCs	10	IN	4,000	LF	$ 160.00	$ 640,000	
		14	IN	10,000	LF	$ 224.00	$ 2,240,000	
		20	IN	11000	LF	$ 320.00	$ 3,520,000	
					LF	$ -	$ -	
					LF	$ -	$ -	
							$ -	
s							$ -	
	Alignment C				EA	$ 40,000.00	$ -	
	Alignment E				EA	$ 40,000.00	$ -	
	Alignment I				EA	$ 40,000.00	$ -	
	Alignment J				EA	$ 40,000.00	$ -	
	Alignment K				EA	$ 40,000.00	$ -	

O&M COSTS	Amount	Unit	Value	Cost	
lacement Fund			Total R&R	**$ 3,400,000**	
Annual R&R Fund	1	EA	$ 3,400,000.00	$ 3,400,000	1/50th of Base Construction Cost
M Costs			SBWR O&M	**$4,500,000**	
	10000	AFY	450.00	$4,500,000	
				$0	
			TOTAL ANNUAL O&M COSTS	**$ 7,900,000**	

Cost of Tertiary Filtration Expansion

sion			Subtotal
			$ 12,000,000
		RAW CONSTRUCTION COST	**$ 12,000,000**
Construction Contingency		20%	$ 2,400,000
		BASE CONSTRUCTION COST	**$ 14,400,000**
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 4,320,000
			$ -
Project Contingency		10%	$ 1,872,000
		TOTAL PROJECT COST	$ 20,592,000

nsion	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
							$ 12,000,000
Filters		12	mgd	12000000	gallons	$ 1.00	$ 12,000,000

t: SBWR Strategic and Master Plan

onent: Long-Term NPR Cost Estimate

Date: February 7, 2014
Project Number: 0057-007.02

Prepared by: ER

ype: Conceptual Design

ost Summary by Division

sion	**Subtotal**	**Notes**
k	$ 118,669,600	
e	$ 22,500,000	
	$ 8,700,000	
nent	$ -	
nical	$ -	
cal	$ 1,740,000	
	$ 870,000	

	RAW CONSTRUCTION COST		**$ 152,479,600**
Construction Contingency		20%	$ 30,495,920
	BASE CONSTRUCTION COST		**$ 182,975,520**
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 54,892,656
Easements			$ -
Project Contingency		10%	$ 23,786,818
	TOTAL PROJECT COST		$ 261,654,994

sion	**Item**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
k							**$ 118,669,600**	
Vater Company Expansions								
es							$ -	
	Alignment A	4	IN	3700	LF	$ 64.00	$ 236,800	
		6	IN	2600	LF	$ 96.00	$ 249,600	
		8	IN	16800	LF	$ 128.00	$ 2,150,400	
	Alignment D	6	IN	13400	LF	$ 96.00	$ 1,286,400	
		8	IN	29300	LF	$ 128.00	$ 3,750,400	
		24	IN	19200	LF	$ 384.00	$ 7,372,800	
	Alignment E	6	IN	34500	LF	$ 96.00	$ 3,312,000	
		8	IN	7700	LF	$ 128.00	$ 985,600	
		12	IN	10100	LF	$ 192.00	$ 1,939,200	
		30	IN	8600	LF	$ 480.00	$ 4,128,000	
	Alignment K	6	IN	10200	LF	$ 96.00	$ 979,200	
		8	IN	7700	LF	$ 128.00	$ 985,600	
	Alignment L	6	IN	18000	LF	$ 96.00	$ 1,728,000	
		8	IN	12800	LF	$ 128.00	$ 1,638,400	
		10	IN	12100	LF	$ 160.00	$ 1,936,000	
		12	IN	10500	LF	$ 192.00	$ 2,016,000	
	Alignment N	10	IN	8100	LF	$ 160.00	$ 1,296,000	
	Alignment Q	4	IN	37550	LF	$ 64.00	$ 2,403,200	
		6	IN	37550	LF	$ 96.00	$ 3,604,800	
		10	IN	27900	LF	$ 160.00	$ 4,464,000	
		12	IN	16100	LF	$ 192.00	$ 3,091,200	
		18	IN	15550	LF	$ 288.00	$ 4,478,400	
		24	IN	15550	LF	$ 384.00	$ 5,971,200	
	Alignment R	4	IN	2300	LF	$ 64.00	$ 147,200	
		6	IN	9300	LF	$ 96.00	$ 892,800	
		8	IN	2000	LF	$ 128.00	$ 256,000	
	Future Pipelines	6	IN	23000	LF	$ 96.00	$ 2,208,000	
		8	IN	38800	LF	$ 128.00	$ 4,966,400	
		12	IN	900	LF	$ 192.00	$ 172,800	
		16	IN	10200	LF	$ 256.00	$ 2,611,200	
		20	IN	20300	LF	$ 320.00	$ 6,496,000	
		30	IN	33300	LF	$ 480.00	$ 15,984,000	
		30	IN	16400	LF	$ 480.00	$ 7,872,000	
	Milpitas GCs	10	IN	4,000	LF	$ 160.00	$ 640,000	
		14	IN	10,000	LF	$ 224.00	$ 2,240,000	
		20	IN	11000	LF	$ 320.00	$ 3,520,000	
					LF	$ -	$ -	
					LF	$ -	$ -	
							$ -	
s							$ -	
	Alignment E			39	EA	$ 40,000.00	$ 1,560,000	
	Alignment R			13	EA	$ 40,000.00	$ 520,000	
	Alignment N			3	EA	$ 40,000.00	$ 120,000	

O&M COSTS	Amount	Unit	Value	Cost	
placement Fund			Total R&R	**$ 3,700,000**	
Annual R&R Fund	1	EA	$ 3,700,000.00	$ 3,700,000	1/50th of Base Construction Cost
M Costs			SBWR O&M	**$4,500,000**	
SBWR	10400	AFY	450.00		
SBWR	10000	AFY	450.00	$4,500,000	
				$0	
			TOTAL ANNUAL O&M COSTS	**$ 8,200,000**	

Cost of Tertiary Filtration Expansion

sion		Subtotal
		$ 12,000,000
RAW CONSTRUCTION COST		**$ 12,000,000**
Construction Contingency	20%	$ 2,400,000
BASE CONSTRUCTION COST		**$ 14,400,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 4,320,000
		$ -
Project Contingency	10%	$ 1,872,000
TOTAL PROJECT COST		$ 20,592,000

nsion	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
							$ 12,000,000
Filters		12	mgd	12000000	gallons	$ 1.00	$ 12,000,000

Appendix 6A - Summary of Previous Potable Studies

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Appendix 6A: Summary of Previous Studies

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Appendix 6A: Summary of Previous Studies

This appendix summarizes the previous studies that have been completed for potable reuse, which include the following:

- Advanced Recycled Water Treatment Feasibility Study (May 2004)
- Silicon Valley Advanced Water Purification (SVAWPC) Center Documents
- Recycled Water Master Plan (March 2009)
- Draft Potable Reuse Study (Internal Draft, October 2012)

6A.1 Advanced Recycled Water Treatment Feasibility Study (May 2004)

A 2004 TM summarizes a feasibility study by Black & Veatch/Kennedy Jenks regarding the usage of recycled water in various non-potable capacities. The study proposed three alternatives for demonstration projects, as well as five alternatives for a full scale project, analyzed their costs, and discussed possible funding opportunities. Three of these proposed projects, which included centralized advanced water purification facility (AWPF) options, as well as satellite options in the Coyote area, are similar to the projects that are currently being proposed. These alternatives are summarized in Table 6A-

6A.1.1 Demonstration Project Alternative 1 – Coyote Narrows Advanced Recycled Water Treatment (ARWT) Project

This project sought to demonstrate NPR as a means to displace groundwater usage in the Coyote Valley. A portion of the flow from the Silver Creek Pipeline, which has now been constructed to cool Calpine Corporation's proposed MEC, would have been treated by a newly constructed one million-gallon-per-day (mgd) AWPF at or near the MEC. These waters, buffered by a 1-mgd holding tank, and served by a 1-mgd pump station, would then be served via pipelines with a maximum diameter of 8-inches, to be used

The AWPF itself was expected to be 100 ft by 100 ft. Full advanced treatment (FAT) would be used: the entirety of the flow would pass through a membrane filtration (MF) process to prepare the waters for full treatment via RO; the RO effluent would then undergo UV treatment for destruction of organics before dechlorination, acid and anti-scalant addition, and decarbonation as necessary. Chlorine addition

Table 6A-1: Summary of 2004 Proposed Recycled Water Projects

Scale	Name	Area	ID	AWPF Size	Source Waters	Recycled Water Usage
Demonstration	Coyote Narrows Advanced Recycled Water Treatment	Coyote Valley	1	1-mgd	Silver Creek Pipeline	Landscaping and agricultural
Full Scale	AWPF at the San Jose/Santa Clara (SJ/SC) Regional Wastewater Facility	SJ/SC Area	1A	20-mgd	SJ/SC RWF	Non-potable reuse by SBWRP customers (10–mgd to existing, 10-mgd
			1B	45-mgd		The same as above with the addition of 25-mgd of groundwater
	AWPF at or near the Metcalf Energy Center (MEC), plus an RO plant at the	Coyote Valley	2	15-mgd	Tertiary treated waters from the Silver	Irrigation and streamflow augmentation

Three options were considered for brine disposal. The first option entailed discharging to a nearby sewer main, which would flow to the SJ/SC RWF. As this would increase the TDS through the plant, there was a concern that even this negligible effect on the TDS that would accompany such a small flow might be resisted by existing NPR customers. In that case, the second option, a mechanical brine concentrator, would be provided to prepare a solids/slurry to be hauled offsite for disposal. A third option, to be considered in the event that separation was impractical, would have involved the construction of a 41-acre, 2-foot deep, soil-cement lined salt evaporation pond on an existing stormwater detention pond site approximately 1 mile southwest of the AWPF. The brine waste from this pond would be hauled for disposal. The TM concluded that the first option would not be feasible without agreement from South Bay Water Recycling (SBWR), and found the third option to be the most

6A.1.2 Full Scale Alternatives 1A and 1B – Advanced Treated Recycled Water Project at the San Jose/Santa Clara Regional Wastewater Facility

Full scale Alternative 1A would have involved the construction of an AWPF at the RWF to deliver 20-mgd of advanced treated recycled waters to existing and new users in north Santa Clara County for NPR. Alternative 1A expected 54 percent of its effluent to be used by existing SBWRP customers, 21.5 percent

Alternative 1B entailed all of the construction of Alternative 1A, but added a component of indirect potable reuse by increasing the size of the ARWT to 45-mgd, and discharging that 25-mgd capacity for IPR via groundwaterrecharge

The design of the plant would be the same FAT process as discussed in 3.1.4.1, with the exception that MF reject was expected to be routed back to the head of the RWF. In this alternative, the brine would be blended with treated wastewater from the RWF and discharged to San Francisco Bay, rather than

6A.1.2.1 Full Scale Alternative 2 – Coyote Narrows Advanced Treated Recycled Water Project

Full scale Alternative 2 looked to displace groundwater and treated surface water usage in the Coyote Valley in industrial, landscape, and agricultural activities. In addition, approximately 4,400 AFY of recycled water would have been expected to be used for stream-flow augmentation on the Coyote Creek to enhance the habitat of the fisheries. The proposed 15-mgd facility, located at or near the MEC, would have taken advantage of the full capacity of the Silver Creek pipeline by treating its effluent along

The treatment process proposed for this alternative was FAT, as discussed in 3.1.4.1, with the addition of a brine recovery RO process (BRRO). The brine reject from this BRRO would be combined with the MF reject, and discharged through the sewer. The study considered the storage of this blend depending on available sewer capacity. Whereas demonstration Alternative 1 disregarded this method of brine disposal due to increases in the TDS of current RWF effluent, this alternative proposed the construction of a side-stream RO process at the RWF, but only to reduce the TDS of SBWRP product water to pre-

6A.2 Silicon Valley Advanced Water Purification Center Documents

The City and the District have partnered to build the SVAWPC to produce recycled water with lower total dissolved solids (TDS) than current SBWR supplies. Lowering the TDS of recycled water would create more areas within Santa Clara County for recycled water use due to enhanced protection of

The SVAWPC, which will be operated by the District, will treat secondary effluent from the RWF and treat it with microfiltration (MF), reverse osmosis (RO), and ultraviolet disinfection. The product water from the SVAWPC will be combined with the tertiary recycled water from the RWF, thereby enhancing the quality of recycled water distributed by SBWR. The RWF tertiary effluent currently has a TDS concentration of about 750 mg/L. The target TDS concentration for recycled water is 500 milligrams per

The SVAWPC is located across the street from the RWF and is scheduled to start operation in summer 2013.

The following documents are available for the SVAWPC:

- Advanced Recycled Water Treatment Feasibility Project, September 2004
- Engineer's Report, December 2009
- Construction Documents

A centralized AWPF, if pursed, would be located adjacent to the SVAWPC.

6A.3 San Jose Water Company Recycled Water Master Plan (March 2009)

The San Jose Water Company (SJWC) commissioned the development of a Recycled Water Master Plan (Master Plan) to detail the short-term and long-term SJWC goals with regard to recycled water development and use; recycled water planning and modeling criteria; recycled water customers, estimated recycled water demands, and associated distribution system alignments; and cost analysis for

The Master Plan includes estimated recycled water demands and identifies recycled water alignments. The market assessment takes into account both short and long-term goals. A total of 17 alignments were identified and considered as part of the RWMP. The District evaluated proposed Alignments C, D, and E of the Master Plan because these alignments were located in the vicinity of the Penitencia ponds. It was assumed that Alignments C and D would be constructed by the time the Penitencia IPR alternative

In terms of cost sharing, it was assumed that if a recycled water pipeline were to be sized and operated to provide recycled water for groundwater recharge, that the District would cost-share with the SJWC to install those facilities. For the purposes of the RWMP, it was assumed that the District would pay for its proportionate share of the actual recycled water demand used by that alignment from the point of connection to the District's delivery point. This includes all infrastructure upstream of the District's delivery point, but does not include any infrastructure downstream. Similar to the cost sharing

6A.4 Draft Potable Reuse Study (Internal Draft, October 2012)

The objective of this study was to evaluate the feasibility of integrating potable reuse projects with District water supplies, existing facilities, and operations, and identify potable reuse project concepts to achieve the District's target of expanding total recycled water use to minimum 10 percent of total water use county-wide by 2025. Groundwater replenishment (GWR) is currently the preferred option for implementing IPR for the District. The District identified a variety of feasible options for implementing

Recommended GWR projects based on cost, operational efficiency, and/or permitting considerations included: 1) the Los Gatos Groundwater Recharge System Concept; 2) the Coyote Groundwater Recharge System Concept; and, 3) the Injection Well Extension Concept to expand the capacity of the

The Los Gatos and Injection Well Extension GWR project concepts (Projects 1 & 3) form one larger project concept. This project concept included the following elements:

- The existing Los Gatos percolation ponds receive water from the Los Gatos Creek and imported water from Central Pipeline. Storage is provided at the Vasona and Lexington Reservoirs before water is released to the percolation ponds. Should the existing supplies be displaced by purified recycled water, water that normally is conveyed from Lexington Reservoir to the percolation ponds could be transferred to a WTP or used in other parts of the recharge system.
- Injection wells would be developed west of the Los Gatos percolation ponds to increase the total amount of water to be recharged.
- The capacity of a combined project (GWR through percolation ponds and injection wells) was estimated to be 33,000 AFY.
- The new facilities and pipelines that would be required are a 30-mgd centralized AWPF, injection wells, and 14.5 miles of 30-inch pipeline from central AWPF to Los Gatos recharge system, including the percolation ponds and injection wells. The project could be implemented in phases by starting with GWR through the percolation ponds and constructing injection wells

The Coyote GWR project concept (Project 2) includes the following elements:

- This project concept depends on an institutional agreement between the District and the City to deliver NPR recycled water from the SBWR Silver Creek Pipeline to the new satellite AWPF. The AWPF would have a total capacity of 5 mgd.
- GWR would occur through percolation ponds in the District's Coyote recharge system, which would be reconfigured to be off-stream ponds. The recharge capacity of the off-stream pond was anticipated to be 5,600 AFY.
- New facilities and pipelines that would be required are a 5-mgd satellite AWPF located near the Metcalf Energy Center, and a pipeline to the percolation pond.
- This project concept assumes that the Main Avenue and Madrone Pipelines Restoration Project, which are part of the Water Supply and Infrastructure Master Plan (WSIMP) element to secure existing supplies and infrastructure, move forward. Also, the project concept includes a bypass

- RO concentrate disposal was assumed to return to the sanitary sewer to be treated at the RWF outfall. It was assumed that this would increase salinity to SBWR; however, the SVAWPC would

6A.5 Draft Potable Reuse Project Concepts (2012)

Both of the concepts discussed in Section 6A.4 would face a variety of challenges. A series of technical memoranda (TM) numbered one through eight were prepared to anticipate and understand the various logistical and legal challenges of indirect potable reuse and offer viable IPR solutions for problems faced by the Santa Clara Valley sub-basin. A summary of their contents are listed below. The contents of TM

1. TM 1 discusses the regulatory requirements of groundwater recharge, reservoir augmentation, and direct potable reuse.
2. TM 2 focuses on the regulatory requirements of discharging recycled water into creeks and streams, particularly as a means of recharging aquifers. The environmental challenges, which dictate a majority of the regulatory requirements, are discussed in detail.
3. TM 3 evaluates the public health risks of recycled water used in various capacities by summarizing numerous recycled water case studies, and discusses lessons which can be drawn from mistakes which have been made in the past.
4. TM 4 explores the quality of "surface reservoir water, the groundwater, and the tertiary treated

   TM 4C evaluates the capabilities of the emerging technologies which could potentially displace the usage of the industry-standard reverse osmosis treatment. For more information, please review Emerging Advanced Treatment Technologies, below.
5. TM 5 evaluates the current and potential greenhouse gas emissions impact of potable reuse, and the feasibility of various mitigation measures.
6. TM 6 reviews the results of an intensive computer analysis to assess the feasibility of recharging groundwater basins with recycled water. For more information, please review Retention Time Analysis for IPR, below.
7. TM 7 compares and contrasts the advantages and disadvantages of the previously discussed indirect potable reuse options. This TM also explains why other alternatives are no longer under consideration, and what options exist to dispose of the concentrate from the RO processes which would exist in any reuse scenario. The various options are summarized in Table 6A-1.
8. TM 8 is composed of six separate documents, each focusing on one of the alternative methods of treating and discharging the effluent from the RWF for indirect potable reuse that were

c. TM 8C discusses the Injection Well Extension Concept.
d. TM 8D discusses blending the effluent of a 2.2-mgd satellite AWT facility with imported waters, and discharging that blend to the Penitencia groundwater recharge system
e. TM 8E discusses utilizing the Guadalupe groundwater recharge system, which would only be pursued if demand increased beyond expectations, as the Guadalupe system generally does not have leftover capacity.
f. TM 8F discusses discharging to the Anderson Reservoir. If coupled with the Los Gatos recharge system discussed in TM 8B, this could leverage almost the entirety of the SJ/SC

TM 4C: Emerging Advanced Treatment Technologies

The emerging advanced treatment technologies are meant to create solutions which are less energy-intensive, and more environmentally friendly than the industry standard MF/RO, while providing similar pathogens and salts removal. The combination of ozone and biologically active carbon (BAC) is of particular interest: ozone treatment can provide similar pathogen reduction to RO, but can generate disinfection byproducts (DBPs) and can have undesirable tastes and odors. BAC can mitigate the DBPs

The ozone/BAC combination also does not desalt the water. Desalting alternatives to RO include electro-dialysis, forward osmosis, membrane distillation, electro-dialysis metathesis, and vibratory shear enhanced processing. However, these technologies are not yet established, and thus do not yet provide

TM6: Results of Computer Analysis of Effects of IPR Groundwater Recharge

This TM summarized the results of computer analyses used to assess the groundwater impacts of IPR near the Los Gatos, Coyote, Guadalupe and Penitencia recharge systems. The TM concluded that IPR

These conclusions were reached by comparing modeling results of two scenarios, baseline and IPR, which were both modeled over an 82-year period beginning in 1922 and ending in 2003. In the baseline scenario, existing recharge operations were assumed to continue throughout the modeling period. In the IPR scenario, it was assumed an additional 2,000 AFY of water would be available for recharge every

Three different programs were used in concert to evaluate the two scenarios: The District Water Evaluation and Planning System (WEAP); an existing numerical groundwater flow model for the Plain (GMOD; CH2M HILL, 1992); and, the USGS particle-tracking code MODPATH (Pollack, 1994)

First, WEAP and GMOD were used iteratively. WEAP assumed a natural recharge, and calculated pumping, treated water deliveries, surface water supplies and artificial recharge. These values were the used as inputs for GMOD, which calculated a value for natural recharge. Then the GMOD output was

GMOD output showed IPR resulting in an increase in groundwater storage of 800-AFY, relative to 600-AFY in the baseline scenario.

As expected, this increase in groundwater storage suggests that IPR could mitigate subsidence, which is a known risk to the Santa Clara Plain. Subsidence thresholds for groundwater levels were considered established for ten wells. As the IPR scenario showed levels staying above these thresholds more often,

With these results, MODPATH was then used to determine whether IPR could meet CDPH requirements of detention time. Porosity data from a previous "hydrographic unit delineation study (Iwamura and Parton, 1996)" was employed along with GMOD and WEAP outputs. MODPATH results showed minimal impacts on the existing wells as the retention time requirement of six months is met for all active wells, except for one well in the Guadalupe recharge system, but noteS that a site-specific study would be

Direct Potable Reuse

A direct potable reuse (DPR) system, wherein the purified recycled water is directly introduced into a raw water distribution system, was also considered. Although acceptance of DPR is growing, it must meet stringent regulations and is still not as widely accepted as IPR. Any DPR implementation would have to be accompanied by an extensive public outreach campaign. However, modern water treatment technologies are capable of treating recycled water to meet and exceed modern drinking water

The Central Pipeline System Alternative seeks to supplement water from the State Water Project as necessary based on the allocation in a given year. The study concluded that, with the capability to deliver an average of 15,000 AFY into the Central Pipeline, DPR is a "valuable, reliable and useful water

This option assumes that a centralized 32-mgd AWPF would be located adjacent to the RWF and SVAWPC. The purified recycled water would discharge through 6.6 miles of 42-inch pipe to the Central Pipeline, where the water would combine with imported water and flow to either the Rinconada or the Penitencia Water Treatment Plants, depending on which direction the water in the Central Pipeline is flowing. As those turnouts feed creeks and streams, there would also be an IPR component to this option, necessitating permitting as discussed in TM 2. As regulations for direct potable reuse do not yet

TMs 8A, 8B, 8C, 8D, and 8E: GWR Project Concepts

Five TMs summarize the GWR project concepts that were developed and evaluated by the District, including the following:

- TM 8A: Coyote Groundwater Recharge System

- TM 8B: Los Gatos Recharge
- TM 8C: Los Gatos Recharge with Injection Option
- TM 8D: Penitencia Groundwater Recharge System
- [illegible]

These five project concepts are summarized in Table 6A-2. As summarized under Section 6A.4, the Draft Potable Reuse Study concluded that the Los Gatos project concept (with recharge ponds and injection wells) and the Coyote project concept are the preferred alternatives

Table 6A-2: Summary of Potable Reuse Options per TM 7 and 8a thru 8e

Name of Option	TM	Recharge Capacity, AFY	Implment-ation Issues	Proposed Location	Proposed Conveyance	Discharge Location	Comments
Coyote Groundwater Recharge System	8A	5,600	Requires pond to be converted off-stream	New 5-mgd AWT facility near Metcalf Energy Center	One mile of 18-inch pipe	Coyote Pond	Could be viewed as a demonstration, due to its smaller scale
Los Gatos Recharge	8B	20,000	-	New 18-mgd AWT facility near RWF	14.4-mile of 30-inch pipe	Los Gatos Ponds	-
Los Gatos w/ Injection Option	8C	33,000	Possibly eliminates blending requirement	New 29.5-mgd AWT facility with advanced oxidation near RWF	14.4-mile of 30-inch pipe	20k AFY to Los Gatos Ponds; 13k AFY to injection wells	Allows for greater scalability
Penitencia Groundwater Recharge System	8D	2,450	Coordination with 2009 SJWC Recycled Water Master Plan	New 2.2-mgd AWT facility at Capitol Site	14,600 LF of 12-inch pipe	Penitencia Ponds	Gains in storage insufficient to attenuate depletion from dry periods
Guadalupe Groundwater Recharge System	8E	N/A	N/A	N/A	N/A	Guadalupe Ponds	Can only handle additional capacity during critically dry years

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Appendix 6B - Reservoir and Streamflow Augmentation Opportunities

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Appendix 6B: Reservoir and Streamflow Augmentation Opportunities

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6B.1 Introduction

SBWR and SCVWD have investigated various water recycling opportunities, including streamflow and reservoir augmentation, served by the SJ/SC RWF, since the late 1990s. This appendix documents previous analyses and further evaluates using purified recycled water for reservoir or streamflow

Surface water augmentation is an IPR strategy as defined by amendments to the California Water Code (CWC) through Senate Bill (SB) 918. Streamflow augmentation is not specifically categorized as IPR, although it has potential to augment surface water and groundwater (in cases where the discharge is to an unlined surface water) that serve as municipal water supplies. These recycled water pathways are

CWC Section 13561(d) defines surface water augmentation as "the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply." For the SBWR, this concept would use purified recycled water that has undergone advanced treatment. The purified recycled water would be blended with untreated water in a reservoir. The blended water would be treated and disinfected at a drinking water treatment plant and distributed into the drinking water system. This differs from a DPR project where the purified recycled water would be introduced directly

Streamflow augmentation involves discharge of purified recycled water into streams or creeks for purposes of environmental enhancement and/or in cases where the surface water channel is unlined, for groundwater recharge. If the primary purpose of streamflow augmentation is the planned replenishment of the groundwater basin, a streamflow augmentation project could be considered an IPR application – groundwater recharge via surface spreading – and groundwater replenishment (GWR)

In the past, the main driver for streamflow augmentation was to divert treated wastewater flows away from San Francisco Bay because there was a limit on effluent discharges. Today there are other drivers for the reuse of treated wastewater for both streamflow and reservoir augmentation. These include augmenting potable water supplies, making beneficial use of recycled water and no longer treating it as a waste, augmenting natural streamflow during times of drought, and reducing the amount of imported water used to meet minimum streamflow requirements. Purified recycled water used for these

6B.2 Reservoir Augmentation

This section describes regulations pertaining to reservoir augmentation and summarizes previous investigations by SBWR and SCVWD.

6B.2.1 Regulations

Table 6B-1 documents pertinent statutory and regulatory requirements for reservoir augmentation.

The draft surface augmentation regulations are currently being developed, but are not yet available for public review. Those draft regulations are expected to include requirements for testing of constituents of emerging concern (CECs). Currently, CEC monitoring for NPDES permitting of surface water discharge

Table 6B-1: Summary of Pertinent Statutes and Regulations for Reservoir Augmentation

Date	Activity/Action
December 31, 2016[a]	SB 918 statutory deadline for the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), formerly the California Department of Public Health (CDPH), to adopt uniform water recycling criteria for surface augmentation based on review by an expert panel. DDW has been working on an internal draft of the regulations, but has provided no information as to when a draft will be available for public review/comment. The expert panel and stakeholder advisory group that have been convened to advise DDW on
July 1, 2014	The CDPH's Drinking Water Program (DWP) was officially moved to the SWRCB to consolidate all major water quality programs within a single department to better manage and protect water resources and ensure safe drinking water. The reorganization created a new SWRCB DDW joining the existing Divisions of Water Quality, Water Rights, Financial Assistance, and Administrative Services and move the Safe Drinking Water State Revolving Fund (SRF) under the Division of Financial Assistance, where the Clean Water SRF is currently managed. It maintains regulatory staff at the local level answering directly to the SWRCB through the newly created Division of Drinking Water. The Administration has stated that moving the DWP consolidated the recycled
February 15, 2014[a]	Assembly Bill 322 statutory deadline for CDPH to convene the expert panel for DPR and reservoir augmentation. The stakeholder advisory group has been formed and its first meeting was February 21, 2014 at which they provided input on the expert panel members (CDPH website updated February 13,
October 8, 2013	Adds Section 13263.7 to the CWC such that compliance with effluent limitations and permit requirements for the release or discharge of recycled water suitable for reservoir augmentation into a conveyance facility may be determined at the point where the recycled water enters the conveyance facility but prior to co-

Date	Activity/Action
September 30, 2010	The Governor approved SB 918, which amended Sections 13350 and 13521 of, and adds Chapter 7.3 (commencing with Section 13560) to Division 7 of, the CWC. The new statutes defined DPR, IPR for groundwater recharge, and reservoir augmentation (see Appendix B). The statute also required CDPH to adopt uniform water recycling criteria for groundwater recharge by December

Note:
a. This date is mandated by statute.
b. For advisory group see http://www.cdph.ca.gov/certlic/drinkingwater/Pages/RW_DPR_advisorygroup.aspx (accessed February 15, 2014) for expert panel see http://www.cdph.ca.gov/certlic/drinkingwater/Pages/RW_SWA_DPRexpertpanel.aspx (accessed February 15, 2014).

6B.2.2 RWQCB Approval

The RWQCB is responsible for regulating recycled water discharges to surface water. The discharge of a treated wastewater (including purified recycled water) to a water of the United States is regulated under the Clean Water Act (CWA), CWC, and applicable regulations for inland surface waters, and is subject to an NPDES permit issued by the RWQCB[1]. Effluent limitations included in the NPDES permit are based on all applicable water quality objectives in the Quality Control Plan (Basin Plan), water quality criteria in the California Toxics Rule (CTR), and implementation measures for the CTR in the SWRCB Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP). The CTR criteria and SIP are applicable to discharges of wastewater to all inland surface waters and enclosed bays and estuaries of California, except where existing State objectives have been previously adopted and are more restrictive, where site-specific objectives have been adopted by the

6B.2.2.1 California Toxics Rule

The CTR, which was adopted by USEPA in 2000, includes aquatic life criteria for 23 priority pollutants and human health criteria for 57 priority pollutants. The freshwater criteria are expressed as: 1) Criteria Maximum Concentrations (CMCs) that are equal to the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without a deleterious effect; and 2) as Criteria aquatic life can be exposed for an extended period of time (four days) without a deleterious effect.[2] The CCC criteria are more stringent than the CMC criteria.

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[1] The USEPA reviews and can disapprove NPDES permits.

The CTR human health criteria are based on exposure to a pollutant that occurs through the ingestion of water and contaminated fish and shellfish. In calculating the criteria, the underlying exposure assumptions are: 1) the consumption of two liters per day of water at the criteria concentration and the consumption of 6.5 grams per day of fish and shellfish contaminated at a level equal to the criteria concentration but multiplied by a bioconcentration factor (water and organisms criteria); and 2) the consumption of 6.5 grams per day of fish and shellfish contaminated at a level equal to the criteria concentration but multiplied by a bioconcentration factor (organism only criteria). The CTR human

6B.2.2.2 State Implementation Policy

The SIP, which was adopted by the SWRCB in 2000 and amended in 2005, includes: procedures to determine which priority pollutants need effluent limitations (e.g., a reasonable potential analysis); methods to calculate water quality-based effluent limitations (this includes statistical equations that adjust CTR criteria for effluent variability and for averaging periods and exceedance frequencies of the criteria/objectives); and policies regarding mixing zones, metals translators, monitoring, pollution prevention, reporting levels for determining compliance, and whole effluent toxicity control. Using the SIP, permit limits are established for those CTR constituents that have the reasonable potential to cause or contribute to an excursion above any applicable criteria including consideration of a mixing zone (e.g., dilution factor). The SIP also allows the SWRCB to grant an exception to complying with priority pollutant criteria in situations where site-specific conditions in individual water bodies or watersheds

6B.2.2.3 Total Maximum Daily Loads

Surface waters that do not meet water quality standards are placed on the CWA Section 303(d) list of impaired waters, and the RWQCB must complete a Total Maximum Daily Load (TMDL) for each listing. The TMDL is a calculation of the maximum amount of a pollutant from point and non-point sources that a water body can receive and still meet water quality standards with a margin of safety. The TMDL and implementation plan are incorporated into the Basin Plan as amendments. The wasteload allocations established in TMDLs are translated into NPDES permit limits to ensure that compliance with the

For surface waters on the 303(d) list, there is some uncertainty regarding a new discharge to an impaired water. The Ninth Circuit Court of Appeals decision regarding a new discharge to an impaired water (Friends of Pinto Creek vs. USEPA) interprets 40 Code of Federal Regulations Part 122.4(i). This is

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[2] Table 3-4 in the Basin Plan includes objectives for metals and cyanide based on the CTR CCC freshwater criteria, as well as converting the criteria to 1-hour average objectives

USEPA's rule governing new sources and new dischargers to impaired waters. The court's decision could severely limit a discharger's ability to obtain an NPDES permit for a new discharge if the water is impaired and/or a wasteload allocation for the new discharge has not been addressed in a TMDL. Thus, depending on the beneficial use of the receiving water and reasonable potential, or the 303(d)/TMDL for an impaired water, the requirements included in an NPDES permit could be more stringent than

The 2010 USEPA approved 303(d) list for California includes Anderson Reservoir, which is impaired for mercury and polychlorinated biphenyls.[3] The proposed TMDL completion date for each pollutant is 2019. The SWRCB is developing a statewide water quality control program for mercury that will include: 1) a mercury control program for 73 impaired reservoirs (including Anderson Reservoir); and 2) mercury water quality objectives.[4] The water quality objectives will likely be expressed as methylmercury (MeHg) concentrations in fish and will apply to all California inland surface waters, enclosed bays, and estuaries. One of the key permitting issues is if compliance with the MeHg fish tissue objective will be based on evaluating fish tissue in receiving waters or if the RWQCB will convert the fish tissue objective into a water column-based permit limit. Depending on the fish consumption factor used in the derivation, the MeHg water column-based permit limits could be very low. The tentative date for adoption of the MeHg objectives is 2014. Strategies to counteract MeHg accumulation in fish in impaired reservoirs may include source control, reservoir management (oxygenation, redox

6B.2.2.4 Basin Plan

SCVWD has studied surface water augmentation in Anderson Reservoir (SBWR 2001, District 2012). The 2011 San Francisco Bay Basin Plan[5] designates the following existing beneficial uses for Anderson Reservoir:

- municipal and domestic supply (MUN);
- groundwater recharge (GWR);
- commercial and sport fishing (COMM);
- cold freshwater habitat (COLD);
- fish spawning (SPWN);
- warm freshwater habitat (WARM);

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[3] http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303dlists2006/swrcb/state_final303dlist.pdf (accessed February 17, 2014).
[4] http://www.swrcb.ca.gov/water_issues/programs/mercury/ (accessed February 17, 2014).
[5] California RWQCB, San Francisco Bay Region, San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan), 2011

- water contact recreation (REC-1) (the water quality objectives apply, but water contact recreation is prohibited or limited to protect public health); and
- noncontact water recreation (REC-2)

Based on the MUN and aquatic life uses for Anderson Reservoir, all of the CTR criteria would be considered for establishing NPDES effluent limitations based on reasonable potential. There are a number of priority pollutants with extremely stringent CTR human health criteria (water and organisms) that will be difficult to meet at the end-of-pipe even using advanced treatment. Examples of some these pollutants include three disinfection byproducts: 1) N-nitrosodimethylamine (NDMA) – 0.69 nanograms per liter (ng/L); 2) Chlorodibromomethane (CDBM) – 0.401 micrograms per liter (ug/L); and

Unless a mixing zone is granted, the CTR criteria must be met end-of-pipe. The allowance of mixing zones is discretionary and is determined on a discharge-by-discharge (and pollutant-by-pollutant) basis. For completely mixed discharges, the amount of receiving water available to dilute the effluent is determined by calculating the dilution ratio (i.e., the critical receiving water flow divided by the effluent flow). For incompletely mixed discharges, an independent mixing zone study must be conducted and the dilution factor approved by the RWQCB. In addition, the mixing zone must be as small as practicable

If a mixing zone is not allowed, in order to meet these criteria end-of-pipe, additional treatment processes would likely be required. Removal of CDBM and DCBM would likely require air stripping or granular or biologically activated carbon and removal of NDMA would require additional ultraviolet [illegible]

For the COLD beneficial use, the following Basin Plan objectives apply: 1) the natural receiving water temperature shall not be altered unless it does not adversely affect beneficial uses; and 2) the temperature of any cold or warm freshwater habitat shall not be increased by more than 5 degrees Fahrenheit above natural receiving water temperature. Depending whether a mixing zone is allowed, compliance with the temperature requirements might require additional treatment or mitigation

Other future state policies (for example the forthcoming Nutrient Policy and Toxicity Policy) will impact treatment for inland water discharges and may require additional treatment. The Basin Plan currently contains a narrative biostimulatory objective for surface waters to prevent discharges of substances that [illegible]

NPDES permits also have more significant associated civil and criminal liability for permit violations in comparison to Waste Discharge Requirements (WDRs) or Water Recycling Requirements (WRRs) issued for water recycling projects and land disposal

6B.2.3 DDW Approval

DDW, formerly CDPH, has developed an internal draft of its surface water augmentation regulations, but has not yet released the draft for informal or formal public review. Since the regulatory criteria are not yet available (adoption due by December 31, 2016), approval of any reservoir augmentation project by

To date, only the City of San Diego is actively considering the use of highly purified recycled water for reservoir augmentation and is discussing permit requirements with DDW and the San Diego RWQCB. The City began meeting with the RWQCB in 2008 about the Water Purification Demonstration Project (WPDP). In August 2012, the City of San Diego submitted a proposed regulatory compliance approach to the San Diego RWQCB for the City's IPR/Reservoir Augmentation Project at the San Vicente Reservoir. The proposed full-scale project would supplement the roughly 240,000 AF San Vicente Reservoir with up

The proposed approach identified two procedural questions that would have to be addressed prior to the RWQCB considering an NPDES permit for the project:

- Modifications by the RWQCB and USEPA to the 303(d) listings for the San Vicente Reservoir. It is impaired for chloride, color, manganese, pH, and sulfates, with TMDL completion dates of 2019.
- Modifications to the Basin Plan by the RWQCB

Other key permitting issues included:

- Interpretation/compliance with the Basin Plan narrative and numeric objectives for nitrogen and phosphorus, and with dissolved oxygen; and
- Compliance with specific CTR criteria (with or without a mixing zone)

In February 2013, the San Diego RWQCB issued a letter concurring with the proposed regulatory approach and reaffirming its support for the project. On April 23, 2013, the San Diego City Council unanimously accepted the WPDP final report and directed staff to bring forward to the City Council preferred plans for both IPR and DPR systems. Project updates are available at

If reservoir augmentation is considered for Anderson Reservoir, compliance with applicable requirements should be evaluated in more detail along with a permitting strategy that would address whether any regulatory modifications may be necessary

In March 2012, the City of San Diego submitted a proposal to the former CDPH prepared by the WPDP team to obtain concept approval from CDPH for the San Vicente Reservoir Augmentation Project. The City began meeting with CDPH in 2008 about the WPDP. The project's Independent Advisory Panel, organized through the National Water Research Institute, reviewed the March 2012 proposal. The key

- An enhanced wastewater source control program modeled after the Orange County Sanitation District's program for the Orange County Water District's Groundwater Replenishment Project.
- Modifications to the North City Water Reclamation Plant such as flow equalization and full nitrification for secondary treatment.
- Advanced treatment for the entire flow stream using RO and advanced oxidation to meet CDPH requirements; establishing critical control points monitoring; and establishing measures to identify and validate treatment malfunctions and divert advanced treated recycled water in approximately 10 hours (this is the approximate retention time in the conveyance pipeline to the reservoir).
- Reservoir requirements including a 12-month hydraulic retention time; minimum dilution of advanced treated recycled water with ambient reservoir water of 100:1; discharge above the thermocline and withdrawal of reservoir water below the thermocline (when present).
- Water from the reservoir to be treated at a full conventional water treatment plant prior to

In September 2012, CDPH issued a letter to the City approving the San Vicente Reservoir Augmentation Concept and concluding that "the project, as conceived, when properly designed, constructed, and operated, will not compromise the quality of water derived from the San Vicente Reservoir."[6] More detailed information on design, pathogen reduction, operations and response plans, and water quality monitoring would need to be developed as part of an engineering report for approval by DDW.

Given the successful approval of the San Vicente Reservoir Augmentation Concept approach and in the absence of adopted regulations from DDW, the approach for DDW approval for an SBWR reservoir augmentation project would likely follow the San Vicente project model contingent upon any input from

In addition, in accordance with Health and Safety Code Section 116551, DDW cannot issue a permit to a public water system or amend a valid existing permit for the use of a reservoir as a source of supply that is directly augmented with recycled water unless DDW: 1) performs an engineering evaluation that evaluates the proposed treatment technology and finds that the proposed technology will ensure that the recycled water meets or exceeds all applicable primary and secondary drinking water standards and poses no significant threat to public health; and 2) holds at least three public hearings in the area where

In the absence of specific water quality requirements developed by state agencies at this time, it is reasonable to assume that requirements for a reservoir augmentation project would include those developed for the San Diego WPDP:

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[6] CDPH, letter to Roger Bailey and Marci Steirer, regarding "City of San Diego San Vicente Reservoir Augmentation Concept," September 7, 2012.

- Compliance with all federal and state drinking water maximum contaminant levels (MCLs) and secondary MCLs;
- Remaining below all DDW notification levels (NLs);
- Compliance with all requirements of DDW's IPR regulations for Groundwater Replenishment - Subsurface Application (Title 22 Division 4 Article 5.2). These requirements were used for the WPDP because DDW has not issued draft regulations for surface water augmentation.
- Compliance with all established discharge requirements from the RWQCB, including Basin Plan Objectives, CTR requirements for freshwater and for human health, and SIP. It should be noted

6B.2.4 Previous Studies

Reservoir augmentation was identified in the SBWR Expansion Strategies Near-Term Development Plan (2001) and Long-Term Strategies (2000) (SBWR, 2001). The Long Term Concepts Plan developed as part of SBWR Phase 2 Master Planning identified surface water augmentation at Anderson Reservoir. The most recent assessments were conducted by SCVWD in the Potable Reuse Report Draft TMs (District,

The Potable Reuse Report Draft TM 8F Anderson Reservoir Surface Water Augmentation Alternative (District, 2012) identified three concepts for a reservoir augmentation project at Anderson Reservoir: 1) extending the Los Gatos Groundwater Recharge Alternative with an upsized pipeline (6.6 miles) and an additional pipeline (21.4 miles) from an advanced water purification facility (AWPF) located adjacent to the RWF to Anderson Reservoir to deliver 20,000 AFY to the reservoir; 2) a 28-mile pipeline from the AWPF directly to Anderson Reservoir to deliver 20,000 AFY; and 3) a satellite AWPF using SBWR recycled

Although some of the assumptions of Draft TM 8F are no longer valid due to results from the San Diego project, it is believed that the general findings remain valid. Deliveries from the AWPF to Anderson Reservoir would be limited to only certain months of the year to meet District reservoir operations requirements. To meet the augmentation goals over that seasonal schedule for the first two concepts, the AWPF's capacity (as envisioned at the time of this District study) would need to be increased from

SCVWD identified dilution and mixing zones, potential future nutrient criteria, temperature changes, toxicity, disinfection byproducts, and mercury as potential regulatory concerns for the proposed project. SCVWD concluded that surface water augmentation at Anderson Reservoir is technically feasible and could make significant use of recycled water from the RWF; however, all three alternatives were expected to be considerably more expensive and would have more permitting challenges than other IPR options considered by SCVWD. Therefore, reservoir augmentation was not recommended to be pursued depending upon the outcome of the final surface water augmentation regulations.[7] However, as noted in Table 6B-1, final DDW regulations are not expected until December 2016 at the earliest.

6B.3 Streamflow Augmentation

This section describes regulations pertaining to streamflow augmentation and summarizes previous investigations by SBWR and SCVWD.

6B.3.1 Overview

SCVWD previously identified regulatory requirements and considerations for streamflow augmentation projects in the Potable Reuse Report Draft TM 2 (District, 2012). Such a project would require an NPDES permit and, if it involves planned groundwater recharge, approval from CDPH, and would be subject to regulation by the California Department of Fish and Wildlife, United States Fish and Wildlife, and National Marine Fisheries Service. Other regulatory issues include in-stream temperature and changes

For an NPDES permit, the requirements could be more stringent than achievable through the existing advanced treatment facility depending on the beneficial uses of the stream designated in the Basin Plan and any applicable dilution. These requirements stem from the Basin Plan, CTR, SIP, or any applicable TMDL containing allocations.

SCVWD has studied streamflow augmentation in the Coyote and Guadalupe watersheds. Table 6B-2 presents the existing and potential beneficial uses for these water bodies from the 2011 San Francisco Bay Basin Plan. Only Los Gatos Creek has been designated as an existing MUN waterbody, in which case the CTR human health criteria apply and, depending on reasonable potential, could result in very stringent permit limits, which may affect acceptable treatment options. It is unlikely that the RWQCB

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[7] Santa Clara Valley Water District, Potable Reuse Report, Draft TM 7, Comparison of Potable Reuse Concepts (2012)

Table 6B-1: Existing and Potential Beneficial Uses for Guadalupe and Coyote Watersheds

Water Body	MUN	FRSH	GWR	COMM	COLD	MGR	RARE	SPWN	WARM	WILD	REC-1	REC-2
Guadalupe Watershed												
Guadalupe River			E		E	E	E	E	E	E	E	E
Los Gatos Creek	E	E	E		E	P	E	P	E	E	E	P
Guadalupe Creek		E	E		E	E	E	E	E	E	E	E
Alamitos Creek		E	E		E	E	E	E	E	E	E	E
Coyote Creek Watershed												
Coyote Creek			E	E	E	E	E	E	E	E	E	E
Upper Penitencia Creek		E	E		E	E	E	E	E	E	E	E
Lower Penitencia Creek									E	E	E	E

Source: California RWQCB, San Francisco Bay Region, San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan), Table 2-1, 2011.

Notes: MUN: municipal and domestic supply; FRSH: freshwater replenishment; GWR: groundwater recharge; COMM: commercial and sport fishing; COLD: cold freshwater habitat; MGR: fish migration; RARE: preservation of rare and endangered species; SPWN: fish spawning; WARM: warm freshwater habitat; WILD: wildlife habitat; REC-1: water contact recreation; REC-2: noncontact water recreation; E: Existing beneficial use; P: Potential beneficial use.

Also, future state policies (for example the forthcoming MeHg objectives, Nutrient Policy, and Toxicity Policy) will impact treatment for inland water discharges and may require additional treatment. NPDES permits also have more significant associated civil and criminal liability for permit violations in

6B.3.2 GWR Overview

If the primary purpose of streamflow augmentation is the replenishment of the groundwater basin, and depending on the extent of recharge occurring along a specific reach of stream, a streamflow augmentation project could be considered a planned GWR project and the proposed regulations described in Table 6B-3 would apply. CDPH had a statutory mandate to adopt the GWR regulations by December 31, 2013. The regulations were formally adopted on June 18, 2014 as Title 22 Division 4 Article 5.1. Indirect Potable Reuse: Groundwater Replenishment - Surface Application and Article 5.2

Table 6B-2: Summary of the GWR Regulations

Subject	Requirement
Background Monitoring	Prior to operating a new GWR project, the project sponsor shall collect at least four samples, at least one sample each quarter, from each potentially affected aquif
Boundaries Restricting Construction of Drinking Water Wells	Project proponents must establish: 1) a “zone of controlled potable well construction,” which represents the greatest of the horizontal and vertical distances reflecting the retention times required for pathogen control or for response retention time; and 2) a “secondary boundary” representing a zone of potential controlled potable well construction that may be beyond the zone of controlled potable well construction thereby requiring additional study *Note: Since it is not fully understood how the secondary boundary will be established, it will have to be negotiated with DDW; may lead to more restrictions on well development and required studies; more impacts in*
Source Control	The recycled water must come from a wastewater management agency that administers and implements an industrial pretreatment and pollutant source control program that includes at a minimum: 1) an assessment of the fate of DDW-specified chemicals through the wastewater and recycled water treatment systems; 2) chemical source investigations and monitoring that focuses on DDW-specified and RWQCB-specified chemicals; 3) an outreach program to industrial, commercial, and residential communities for the sewershed tributary to the water reclamation plant to minimize chemical discharge; and 4) an inventory of chemicals, including new chemicals from new sources or changes to existing sources, that may be discharged to the wastewater collection system. The wastewater management agency is in compliance with effluent limits established in the wastewater agency’s RWQCB permit
Total Nitrogen (N)	Must meet 10 mg/L in recycled water or recharge water before or after application (recharge water is recycled water or the combination of recycled water and diluent water). *Note: Depending on the outcome of a Salt Nutrient Management Plan and/or Basin Plan groundwater objectives, a lower N limit may be imposed*
Total Organic Carbon (TOC)	Surface application: $TOC_{max} = 0.5 \text{ mg/L} \div$ Recycled Water Contribution (RWC) in undiluted recycled water prior to application or within the zone of percolation, diluted percolated recycled water with the value adjusted to negate diluent water, or the undiluted recycled water prior to application

Subject	Requirement
	approved CEC indicator occurrence study in recycled water and then propose at least 3 indicators to show performance is > 90%. *The RWC = recycled water/(recycled water + diluent water) based on a 120 month averaging period* Subsurface application: Recycled water TOC_{max} = 0.5 mg/L *Note: For surface application projects, treatment must consider the level of TOC to be achieved or a TOC alternative approved by DDW; for subsurface application projects, the recycled water must receive advanced treatment (see advanced treatment criteria) to achieve the TOC*
MCLs	Recycled water must meet all primary MCLs (except nitrogen compounds) in recycled water; for disinfection byproducts *for surface applications*, compliance can be determined in the recycled or recharge water before or application*;* for disinfection byproducts *for subsurface application*, compliance can be determined in the recycled water or recharge water; must meet all secondary MCLs in recycled water.
Criteria Advanced Treatment (subsurface application projects)	RO • Each membrane element achieves a minimum sodium chloride (NaCl) rejection ≥ 99.0% and an average (nominal) NaCl rejection ≥ 99.2% using ASTM Method D4194-03 (2008), using the following substitute test conditions: – Tests are operated at a recovery ≥ 15% – NaCl rejection is based on 3 or more successive measurements – An influent pH between 6.5 and 8.0 – An influent NaCl concentration ≤ 2,000 mg/L • During the 20 weeks of full-scale operation, the membrane produces a permeate with no more than 5% of the sample results having TOC > 0.25 mg/L. Advanced Oxidation (AOP) • Option 1 - Conduct an occurrence study that identifies 9 indicators representing 9 functional groups, with 0.5-log removals for 7 of the indicators and 0.3-log removals for 2 of the indicators; establish at least one surrogate or operational parameter that reflects the removal of at least 5 of the 9 indicators (one of the surrogates must be monitored continuously); confirm the results using a pilot study via challenge or spiking tests. • Option 2 - Conduct pilot testing that includes challenge or spiking tests

Subject	Requirement
	Product water must meet MCLs. *Note: These requirements apply only to subsurface application or direct injection to a groundwater aquifer. The requirements do not apply directly to surface discharge.*
Pathogen Control	Surface application: At a minimum, recycled water applied must meet California Code of Regulation Title 22 disinfected tertiary effluent requirements All GWR projects: The treatment system must achieve a 12-log enteric virus reduction, a 10-log *Giardia* cyst reduction, and a 10-log *Cryptosporidium* oocyst reduction using at least 3 treatment barriers; for each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than 1.0-log reduction; the retention time credit for virus is 1-log/month. Surface application: If a project meets meet Title 22 disinfected tertiary recycled requirements or provides advanced treatment for the full recycled water flow and 6 months retention underground, a project will be credited with 10-log *Giardia* cyst reduction and 10-log *Cryptosporidium* oocyst
Diluent Water MCLs	Must meet primary MCLs and secondary MCLs with the exception of color, odor, and turbidity. *Note: Significant issue for surface spreading projects that use stormwater for diluent water to obtain diluent water credit and would lower allowable RWC*
Initial RWC	*The RWC = recycled water/(recycled water + diluent water) based on a 120 month averaging period.* Surface application: For surface spreading projects, up to 20% unless an alternative initial RWC is approved by DDW based a treatment processes preceding surface application can reliably achieve a TOC 20-week running average no greater than 0.5 mg/L. Subsurface application: To be determined by DDW. *Note: A surface spreading project must start at 20% unless DDW has approved a higher RWC and advanced treatment is provided to meet a TOC concentration of 0.5 mg/L; a subsurface application project has the*
Increased RWC	Surface application: Sequential incremental increases ≥ 50% and ≥ 75% allowed if: TOC 20-week average for prior 52 weeks = 0.5 mg/L ÷ $\text{RWC}_{\text{proposed max}}$ (e.g., can occur after first year); approved by DDW and RWQCB; received a permit allowing operation at the increased maximum RWC;

Subject	Requirement
	Subsurface application: Increases allowed if: TOC 20-week average for prior 52 weeks = 0.5 mg/L; approved by DDW and RWQCB; received a permit
NLs	Recycled Water: Actions to be taken if an NL is exceeded in the recycled water or recharge water after application (excluding the effects of dilution), including additional monitoring and potentially suspension of application of the recycled water. Diluent Water: Must ensure that diluent water does not exceed an NL and have a plan in place on actions to be taken if exceed an NL for credit prior to the operation of a project, diluent water must meet NLs. *Note: Because DDW can revise or add NLs without going through a public review or notification process, the potential exists that this requirement*
Response Retention Time	Recycled water must be retained underground for a period of time sufficient to identify treatment failures and implement actions, including the plan to provide an alternative water supply or treatment; the minimum time is two months; it must be validated using an added tracer or a DDW-approved intrinsic tracer (first 10% peak tracer unit value arrives at downgradient monitoring point).
Alternatives	A project sponsor can use an alternative if it provides the same level of public health protection; has been approved by DDW; if required by DDW or RWQCB, the project sponsor will conduct a public hearing; an expert panel must review the alternative unless otherwise specified by DDW. *Note: Allows for alternatives to all sections of the proposed GWR*
Engineering Report	Must obtain a DDW-approved engineering report. *Note: To facilitate approval, recommend early and frequent discussions with DDW regarding the report outline and questions regarding the draft report.*

6B.3.3 Previous Studies

SCVWD's Potable Reuse Report Draft TM 2 Stream Flow Augmentation (District, 2012) summarized past studies by the City of San Jose and SCVWD for a streamflow augmentation project along the Guadalupe River and Coyote Creek. In the 1990s, the City evaluated a streamflow augmentation concept as part of its South Bay Action Plan, which included a wide array of actions that would support the City in meeting existing and potential future RWF NPDES permit conditions. Although the City obtained an NPDES implement the project due to the success of SBWR in flow diversion and to decreasing wastewater flows at the RWF.

In 2003, in conjunction with a pilot streamflow augmentation project between SCVWD and Metropolitan water District, SCVWD augmented this project with a WateReuse Research Foundation project to evaluate the water quality impacts of a streamflow augmentation project on groundwater and surface water, assess the required level of treatment for recycled water used for such a project, and identify and recommend solutions to regulatory and implementation issues for a project. The study evaluated the degradation of CECs by natural processes and determined that the RWF recycled water and two of six creek sites studied exceeded a non-regulatory threshold concentration of 50 ng/l perfluorooctane

SCVWD revisited streamflow augmentation in the Draft Potable Reuse Report (District, 2012), considering the use of advanced treated water in the Coyote or Guadalupe Watersheds. SCVWD is party to an agreement with state and federal resource agencies and local environmental groups called the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE). The FAHCE is a negotiated settlement stemming from an SWRCB water rights challenge filed by environmental groups regarding the stream diversion practices of SCVWD, and developed rule curves for reservoir operations. SCVWD is developing its Three Creeks Habitat Conservation Plan (Three Creeks HCP) to obtain an Endangered Species Act Section 10 permit from the National Marine Fisheries Service for potential impacts to steelhead trout from District water supply operations and maintenance activities in the Guadalupe River and Stevens and Coyote Creeks. To fulfill the requirements of the permit application process, SCVWD needs to

Potential issues for a streamflow augmentation project using recycled water include:

- “Increases in stream temperature resulting from discharges higher than the receiving waters (RWQCB Basin Plan and [California Fish and Wildlife] regulation requires that discharge not change in-stream temperatures by more than 5 F or 2.8 C).
- Changes in in-stream flow conditions that have been negotiated through FAHCE and the Three Creeks HCP. This could be particularly problematic on streams such as Guadalupe and Penitencia which are thought to be valuable spawning and rearing habitat for steelhead trout.
- Potential introduction of substances that are biostimulatory, endocrine-disrupting, toxic or chronically toxic into waters containing protected species such as steelhead and Chinook

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[8] Reinhard, M., M. Plumlee, H. Ashktorab, P. John, J. Larabee. (2006) Attenuation of Emerging Contaminants in Streams Augmented with Recycled Water. WateReuse Research Foundation, Alexandria, VA.

[9] Santa Clara Valley Water District, Potable Reuse Report, Draft TM2, Stream Flow Augmentation (2012)

SCVWD concluded that a streamflow augmentation project would require significant environmental study under the California Environmental Quality Act and considerable evaluation to acquire the required permits, much more so than when an NPDES permit was received in 2000 and more than is required for recharge pond projects. It could also be challenging to incorporate streamflow augmentation into the Three Creeks HCP. SCVWD identified the following studies that might be

- Temperature studies, particularly for cold-water fisheries in the watersheds;
- Flow requirements for anadromous fisheries at different life stages;
- Effects of additional stream flow on riparian and aquatic habitat; and

6B.4 Conclusions

Both reservoir and streamflow augmentation projects face a challenging regulatory/permitting environment as surface water discharges of treated wastewater are considered discharge of a “waste” to the waters of the United States. Regulations for reservoir augmentation are currently under development by DDW and projects are approved on a case-by-case basis, requiring extensive coordination with regulatory agencies. Additional study is necessary to demonstrate to regulators and resource agencies that recycled water could be discharged to surface water bodies without negatively affecting wildlife in the study area. These permitting challenges are potentially greater than required for other potable reuse options under consideration. SCVWD’s evaluation of reservoir augmentation alternatives for the Anderson Reservoir, the most promising District location, determined that the costs for reservoir augmentation would be more expensive than other IPR alternatives being considered by

Appendix 6C - Existing Ozone-BAC Installations

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Appendix 6C: Existing Ozone-BAC Installations

Table 6C-1: Projects/Plants Using Ozone-BAC

Facility Name	Location Year Installed (Upgraded)	Scale/ Capacity	Application	Processes	Comments/Source
Fred Hervey Water Reclamation Plant (FHWRP)	El Paso, Texas 1985 (2008)	Full-Scale 10 mgd	Reclaimed Water for Direct Reuse and Aquifer Recharge (Indirect Potable Reuse)	High–pH Lime → 2-stage Recarbonation→ Sand Filtration→ Pre-Ozonation/ Disinfection→ GAC Filtration	• (Oneby, Bromley, Borchardt, & Harrison, 2010) • Ozone primary disinfection • GAC polishing filters for assimilable organic compound (AOC), synthetic organic compounds (SOC) and taste and odor removal • Taste and odor control
Denver Potable Water Demonstration Project	Denver, Colorado 1992	Pilot 70 gpm	Reclaimed Water for DPR	High-pH Lime → Sedimentation→ Recarbonation → Filtration→ UV → GAC Filtration → RO or UF→ Air Stripping→ Post-	• (van Leeuwen, Pipe-Martin, & Lehmann, 2003) Evaluate feasibility for direct potable reuse • Met or exceeded drinking water standards • Removed organic

Facility Name	Location Year Installed (Upgraded)	Scale/ Capacity	Application	Processes	Comments/Source
Lake Arrowhead Water Reclamation Pilot Plant (LAWRPP)	Lake Arrowhead, California 1995	Pilot 5.3 gpm	Reclaimed Water for Potable Reuse	Pre-Ozonation → BAC Filtration → UF → RO → Post-Ozonation	• (Levine, Madireddi, Lazarova, Stenstrom, & Suffet, 2000) • Treatment efficiency tested • Oxidized bulk organics to produce lower
South Caboolture Water Reclamation Plant (SCWRP)	Queensland, Australia 1999	Full-Scale 2.6 mgd	Reclaimed Water for Reuse and River Discharge	BNR Denitrification (MBBR) → Pre-Ozonation→ Coagulation→ DAF→ Sand Filtration→ Ozonation → BAC Filtration→ Post-Ozonation	• (van Leeuwen, Pipe-Martin, & Lehmann, 2003) • Nutrient goals of <1 mg/L TN and <0.1 mg/L TP • 36% COD removal • Less effective against protozoa, bacteria and virus • Most of TN removal is at the BNR plant using a MBBR • Clear water contamination

Facility Name	Location Year Installed (Upgraded)	Scale/ Capacity	Application	Processes	Comments/Source
Goreangab Reclamation Plant	Windhoek, Namibia 2002	Full-Scale 5.5 mgd	Reclaimed Water for Direct Potable Reuse	PAC → Pre-Ozonation → Coag./Flocculation → DAF → Rapid Sand Filtration → Ozonation → BAC Filtration → GAC Filtration → UF → Chlorination/Stabilization	• (Menge, no date) • Blended with 35% surface water • 1-1.5 mg ozone/ 1 mg DOC • Ct – 15 to 20 minutes • High MW compounds oxidized and removed by BAC • Filters – 30 minutes EBCT
F. Wayne Hill Water Reclamation Center (FWHWRC)	Gwinnett County, Georgia 2003 (2006)	Full-Scale 40 mgd	Reclaimed Water for Lake Discharge	Chemical Clarification → Pre-ozonation → Granular Media Filtration or MF → Pre-Ozonation →	• (Oneby, Bromley, Borchardt, & Harrison, 2010) • Used for IPR with discharge ahead of Lake Lanier and potable WTP
Reno-Stead Water Reclamation Facility (RSWRF)	Reno, Nevada 2010	Pilot 10.6 gpm	Reclaimed Water	Phase 1: UF → Ozone/ H_2O_2 → BAC Filtration → Phase 2: Sand Filtration → Ozone/H_2O_2 → BAC Filtration	• (Gerrity, et al., 2011) • Tested as alternative to FAT • Effectively reduced TrOCs • Reduced estradiol and steroid hormones (except estrone) to below MRLs. • BAC reduced TCPP and TCEP

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Appendix 6D - Concentrate Management

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Appendix 6D: Concentrate Management

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Appendix 6D: Concentrate Management Options

This appendix describes concentrate disposal, minimization, and treatment options for the centralized and satellite potable reuse pathways and evaluates these strategies and technologies for concentrate management, including advantages and disadvantages. These concentrate management options were developed in parallel with the pathways (Section 6). One concentrate management option is selected for the purposes of alternatives development (Section 7), which is presented at the end of this appendix. As noted in the implementation plan (Section 10), additional brine management studies will be conducted as part of the programmatic implementation for the long-term potable reuse projects.

Table 6D-1 lists the concentrate disposal and minimization options that are discussed in this appendix.

Table 6D-1: Concentrate Disposal, Minimization, and Treatment Options

Disposal Options	Minimization Options
1. Existing SJ/SC RWF outfall 2. Return for treatment at SJ/SC RWF and SVAWPC 3. Existing regional deep water outfalls 4. Existing regional shallow water outfall 5. New deep water outfall 6. Evaporation ponds 7. Engineered wetlands 8. Existing salt ponds 9. Deep well injection 10. Zero liquid discharge 11. Emerging technologies	1. Inter-stage lime softening 2. High recovery RO 3. Ion exchange enhancing technologies 4. Emerging technologies

6D.1 Contributing Studies

This section summarizes the following contributing studies that have been completed for RO concentrate management, which focused on adding concentrate to the RWF final effluent.

- National Pollutant Discharge Elimination System (NPDES) Permit Compliance Assessment
- Chronic Toxicity Testing of Reverse Osmosis Reject Water at Bench Scale (Final Internal Draft, July 1, 2011)."

6D.1.1 NPDES Permit Compliance Assessment

As part of the NPDES Permit Compliance Assessment TM (Attachment A), the NPDES Permit compliance for chemical constituents for increasing levels of concentrate discharge conveyed from the RO units to the RWF outfall to Mallard (Artesian) Slough was evaluated. For the analysis of chemical constituents, a mass balance model was developed to estimate final effluent concentrations for conventional, non-conventional, and toxic constituents using concentrate percentages in final effluent ranging from 0 to 15 percent.

Whole effluent toxicity impacts are addressed conceptually. However, when the SVAWPC started operation in 2014, the City initiated a chronic toxicity bench-scale testing program to estimate toxicity impacts from various percentages of concentrate in RWF effluent. Additional chronic toxicity testing using *Ceriodaphnia dubia* was conducted in May, June, July, and October 2014 for brine percentages of 0.5, 1, 2, 4, and 8 percent. The chronic toxicity testing passed for these brine percentages, which indicates that brine concentrations up to 8 percent in the RWF outfall would not exceed the RWF's permit condition for toxicity. Since the recommended plan would result in brine percentages up to 15 percent, additional toxicity testing should be conducted to better understand the impact RO concentrate discharge up to 15 percent. It would be advisable to test concentrations higher than 15 percent since the brine percentages are based on RWF wastewater flow projections, which may not be realized.

When the when the TM was written in summer/fall 2013, it was thought that an Instream Waste Concentration (IWC), i.e., a dilution credit for toxicity, might be a way to comply with potential toxicity issues caused by brine. An IWC was investigated as part of the City's most recent RWF NPDES permit renewal (the current permit was adopted on September 10, 2014). Due to the uncertainty of the draft statewide toxicity policy, it is unknown how an IWC could be applied under a future toxicity policy. Any possible application of an IWC would be separate from the RWF NPDES permit.

It is expected that the RWF will not have significant NPDES Permit compliance issues for final effluent mixed with 15 percent concentrate, if City staff closely monitor final effluent concentrations for ammonia and cyanide. As the concentrate percentage in the final effluent increases, it is recommended that RWF staff continue their current standard practice of sampling early in the month for ammonia and cyanide. If an elevated value is observed, it would be prudent to conduct additional sampling to verify the data point. Additionally, with more frequent sampling, the monthly average values are expected to comply with the AMELs for cyanide and ammonia.

6D.1.2 Chronic Toxicity Testing of Reverse Osmosis Reject Water at Bench Scale (Final Internal Draft, July 1, 2011)

The SCVWD conducted acute and chronic toxicity bench scale testing on SJ/SC RWF final effluent blended with 2 percent and 9 percent of RO concentrate extracted from secondary effluent at the RWF between December 2009 and June 2010. Chronic toxicity testing conducted by SCVWD measuring *Ceriodaphnia dubia*, a freshwater flea, for reproduction and *Thalassiosira pseudonana*, a marine diatom, for growth, resulted in several tests in which slight toxicity was observed in the blend but not in the RWF final effluent. Chronic toxicity testing conducted by the City indicated reduced growth in both 2 percent and 9 percent RO concentrate blends compared to control cultures and were therefore toxic.

The test results raised concerns that an AWPF with up to 9 percent of RO concentrate blended with RWF final effluent could lead to increased monitoring requirements and could even lead to sporadic incidents of chronic toxicity. If *Thalassiosira* is found to be more sensitive to blended effluent than *Ceriodaphnia*, then the next National Pollutant Discharge Elimination System (NPDES) permit for the RWF could include a requirement to conduct monthly toxicity testing using *Thalassiosira*. The RWF's recent history of episodic chronic toxicity using *Ceriodaphnia*, which culminated in a RWF's Toxicity Reduction Evaluation (TRE) in 2010, demonstrated that the RWF final effluent is at least occasionally very close to the threshold of unacceptable chronic toxicity using current testing methods.

It was unlikely that the constituents in RWF final effluent which caused sporadic chronic toxicity to *Ceriodaphnia* are the same constituents that occasionally caused toxicity to *Thalassiosira*. *Thalassiosira* appears to be more sensitive to RO concentrate. Based on SCVWD's testing, *Thalassiosira* may also be more sensitive to RWF final effluent without RO concentrate. It is possible that the State Water Resources Control Board (Water Board) could require the RWF to test two chronic test species if both show significant sensitivity to RWF final effluent during the next Effluent Characterization (toxicity screening), conducted approximately one year prior to the next Permit renewal in May 2014. The State's proposed Whole Effluent Toxicity (WET) Policy includes a requirement to use a statistical evaluation tool known as the Test of Significant Toxicity (TST). This could increase the RWF's chronic toxicity trigger exceedances or cause violations, particularly if *Thalassiosira* testing is required in the future.

The report provided several conclusions and possible strategies:

- It may be possible to petition the Water Board to exclude *Thalassiosira* from consideration in the next effluent characterization study prior to the next NPDES Permit renewal. The worst case scenario would be for the Water Board to impose a requirement to routinely test both chronic species.
- The State's proposed WET Policy would replace the RWF's current toxicity triggers with numerical limits. Any exceedance of a numerical limit could be assessed as a violation of the NPDES permit. The results of SCVWD and City testing alone suggested that the additional risk of toxicity is 33.3 percent for Ceriodaphnia using a 9 percent concentrate blend, and 33.3 percent for *Thalassiosira* using both 2 percent and 9 percent concentrate blends. It is likely that the addition of concentrate to RWF final effluent would at least slightly elevate the risk of future WET violations.
- An alternative plan would be to divert the RO concentrate water to RWF headworks. Depending on the underlying factors causing chronic toxicity, passing the RO concentrate through the entire RWF treatment process may decrease the level of toxicity in the effluent as needed. However, returning concentrate to the headworks would increase the TDS of the secondary effluent which would impact the TDS of AWPF feed water; and hence the AWPF product water.

- There is possibility of receiving dilution credit for WET. Nearly all of the chronic toxicity in RWF final effluent observed during the recent TRE was above 50 percent effluent threshold. All of the toxicity observed during the testing conducted by SCVWD and the City was above a 50 percent effluent threshold. This means that a dilution credit equal to the one applied to the RWF for cyanide, which could potentially solve the RWF's WET issues. Subsequent to the completion of this study, the City noted that there may be the possibility of receiving dilution credit for WET under the future statewide toxicity policy, although application and implementation of dilution credits for toxicity remain unclear.

See Attachment B for the full report.

6D.1.3 Conclusions

Based on these previous studies, discharging the RO concentrate to the RWF outfall could have potential impacts on the RWF’s chronic toxicity permit requirement. The City and SCVWD performed additional chronic toxicity testing in 2014 after the SVAWPC became operational. The testing passed for brine percentages up to 8 percent, which indicates that brine concentrations up to 8 percent in the RWF outfall would not exceed the RWF’s permit condition for toxicity. Since the recommended plan would result in brine percentages up to 15 percent, additional toxicity testing should be conducted to better understand the impact RO concentrate discharge up to 15 percent. It would be advisable to test concentrations higher than 15 percent since the brine percentages are based on RWF wastewater flow projections, which may not be realized.

6D.2 Disposal Options

The following concentrate disposal options are discussed in this section:

- Existing SJ/SC RWF Outfall (Disposal Options 1a and 1b)
- Return for treatment at SJ/SC RWF and SVAWPC (Disposal Options 2a and 2b)
- Existing regional deep water outfalls (Disposal Option 3)
- Existing regional shallow water outfall (Disposal Option 4)
- New outfall north of Dumbarton Bridge (Disposal Option 5)
- New outfall to Coyote Point (Disposal Option 6)
- Evaporation ponds (Disposal Option 7)
- Engineered wetlands (Disposal Option 8)
- Existing salt ponds (Disposal Option 9)
- Deep well injection (Disposal Option 10)
- Zero liquid discharge (ZLD) (Disposal Option 11)
- Emerging technologies (Disposal Option 12)

This section provides an overview and a summary of the advantages and disadvantages for each concentrate disposal option.

6D.2.1 Existing SJ/SC RWF Outfall (Disposal Options 1a and 1b)

One straightforward disposal option is to send concentrate from either a centralized or satellite facility to the existing RWF outfall. The RWF outfall is a shallow discharge into the Artesian Slough, which is a tributary to southern San Francisco Bay (Bay). The concentrate stream would be sent to the chlorine contact basins (i.e., those that are not used for recycled water disinfection) to blend with the RWF effluent prior to discharge. This would be similar to the approach that was used at the SVAWPC when it began operation in March 2014.

SCVWD and the City had previously conducted bench-scale testing for acute and chronic toxicity of RWF final effluent combined with 2 percent and 9 percent of concentrate from an RO process treating RWF secondary effluent. The City and SCVWD performed additional chronic toxicity testing using *Ceriodaphnia dubia* in 2014 after the SVAWPC became operational. The testing was conducted in May, June, July, and October 2014 for brine percentages of 0.5, 1, 2, 4, and 8 percent. The chronic toxicity testing passed for these brine percentages, which indicates that brine concentrations up to 8 percent in the RWF outfall would not exceed the RWF's permit condition for toxicity. Since the recommended plan would result in brine percentages up to 15 percent, additional toxicity testing should be conducted to better understand the impact RO concentrate discharge up to 15 percent. It would be advisable to test concentrations higher than 15 percent since the brine percentages are based on RWF wastewater flow projections, which may not be realized.

It should be noted that the RWF effluent will be changing in the future as the RWF treatment processes are upgraded and expanded. Therefore, the additional toxicity testing being conducted after the SVAWPC became operational in March 2014 may not be indicative of future conditions when an AWPF for potable reuse eventually comes online because of the different characteristics of future RWF effluent. Any potential concentrate management concepts that involve the RWF need to be coordinated with the City's Capital Improvement Program by developing a plan to mimic future RWF final effluent combined with the future amount of RO concentrate.

The centralized and satellite pathways would approach this disposal option as described below.

6D.2.1.1 Centralized Facility (Disposal Option 1a)

Figure 6D-1 represents the flow schematic for a centralized facility that conveys concentration to the RWF outfall. A flow balance was developed to calculate the percent of concentrate in the final RWF effluent. Additional information about the flow balance and the calculations are included in Attachment C.

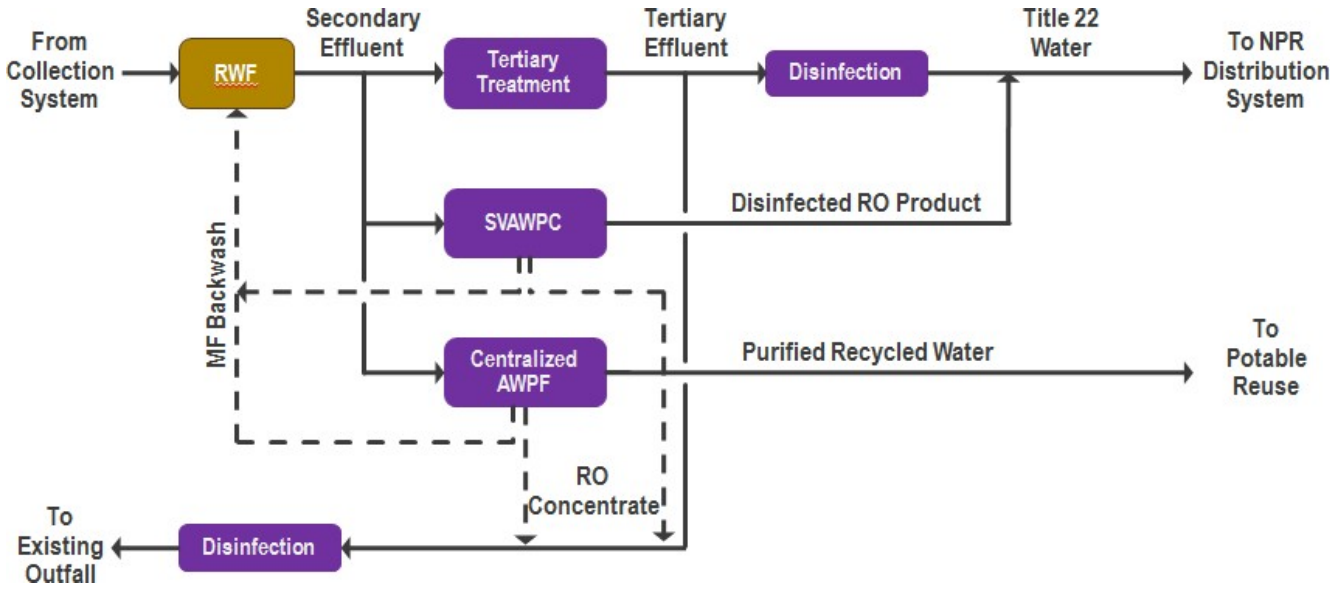
Previous work estimated a range of future influent wastewater flow projections, the magnitude of which depend on the source of the population projections. The range of wastewater flow projections (minimum, average, and maximum) were used to estimate the percent concentrate in the RWF effluent. The wastewater flow projections for 2025 and 2035 are summarized in Table 6D-2.

Table 6D-2: RWF Wastewater Influent Flow Projections for 2025 and 2035

	RWF Wastewater Influent Flow Projections (mgd)		
Year	Minimum	Average	Maximum
2025	105	115	126
2035	109	124	139

Source: Task 2.2.1 TM

Figure 6D-1: Schematic for Centralized Treatment Flow Balance (Disposal Option 1a)



The existing outfall would receive concentrate from both the SVAWPC and the centralized AWPF. The percent of concentrate in the RWF effluent was estimated for the years 2025 and 2035. The seasonal variation of the NPR demands was taken into account since the percent of concentrate in the effluent would increase when the NPR demands are the highest (i.e., summer months). The NPR seasonal demands are based on 2012 data, which are assumed to be typical for subsequent years, and are as follows:

- Minimum NPR flow = 50 percent of annual average NPR flow (February 2012)
- Maximum NPR flow = 160 percent of annual average NPR flow (August 2012)

The percentages of concentrate from both the SVAWPC and the centralized AWPF in the RWF final effluent for the years 2025 and 2035 are summarized in Table 6D-3. These estimates are based on the maximum potable reuse demand assumptions for an average hydrological year. During drought conditions the maximum potable reuse demand may be higher.

Table 6D-3: Centralized Pathway – Amount Concentrate in RWF Final Effluent (Disposal Option 1a)

Year and Demand Assumptions	NPR Seasonal Demand	Amount of Concentrate in RWF Final Effluent [1, 2]					
		Treatment Option 1 (MF +RO + UV)		Treatment Option 2 (MF+RO+AOP)		Treatment Option 3 (Ozone + BAC)	
		mgd	%	mgd	%	mgd	%
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	3.3	4	4.3	5-6	0.9	1
	Summer	4.1	5 – 7	5.1	7 – 10	1.7	2 – 3
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	3.3	3 – 4	5.9	7 – 9	0.9	1
	Summer	4.1	5 – 7	6.7	9 – 14	1.7	2 – 3

Notes:

1 – The range of percentages represents the range for the minimum and maximum wastewater projections. The higher percentages correlate to the minimum wastewater projection (i.e., when the wastewater flow rate is lower, then the concentrate would be a higher percentage of the final effluent) and the lower percentage correlates to the maximum wastewater projection (i.e., when the wastewater flow rate is higher, then the concentrate would be a lower percentage of the final effluent).

2 – RO concentrate in RWF final effluent is combined flows from both the new AWPF and the existing SVAWPC.

The calculated maximum amount of concentrate in the RWF final effluent is 14 percent, which is for year 2035 minimum wastewater projection (109 mgd) for maximum potable reuse (35,000 AFY) during summer conditions when NPR demands are highest. This is within the 15 percent limit previously determined that could be accommodated in the RWF final effluent without exceeding NPDES numerical limits. If the wastewater projections are lower than average, then the concentrate may require treatment in summer months to avoid permit non-compliance. Table 6D-4 lists the advantages and disadvantages of this disposal option for the centralized pathway.

Table 6D-4: Advantages and Disadvantages for Existing SJ/SC RWF Outfall (Centralized Pathway) (Disposal Option 1a)

Advantages	Disadvantages
• Existing outfall with available capacity. • Local strategy within City's control. • Simple operations. • Low capital and operations and maintenance (O&M) costs.	☐ Risk of sporadic chronic toxicity incidences, which will be evaluated further by the City and SCVWD after the SVAWPC is in service. ☐ Regulatory liability for regulatory infractions between the City and SCVWD. Sewer rate payers must be insulated from regulatory liability stemming from discharge. • Challenging institutional roles and responsibilities.

6D.2.1.2 Satellite Facilities (Disposal Option 1b)

This disposal option would require dedicated pipelines (force mains) to convey concentrate stream from each satellite location at Coyote, Penitencia, and Los Gatos to the RWF chlorine contact basin$_s$ (i.e., those that are not used for recycled water disinfection). The main difference compared to the centralized pathway is the higher construction cost for pipelines and higher energy usage to pump the concentrate streams through the pipelines to the RWF outfall. The percent of concentrate in the final RWF effluent was estimated using the flow balance (Attachment B). The percentages of concentrate from both the SVAWPC and the satellite AWPFs in the RWF final effluent for the years 2025 and 2035 are summarized in Table 6D-5. These estimates are based on the maximum potable reuse demand assumptions.

Table 6D-5: Satellite Pathway – Amount of Concentrate in RWF Final Effluent (Disposal Option 1b)

Year and Demand Assumptions	NPR Seasonal Demand	Amount of Concentrate in RWF Final Effluent[1,2]					
		Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
		mgd	%	mgd	%	mgd	%
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	5.9	7 – 9	5.9	7 – 9	1.2	1 – 2
	Summer	6.7	10 – 13	6.7	10 – 13	2.0	3
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	6.0	6 – 9	8.1	9 – 13	1.2	2
	Summer	6.9	8 – 12	9.0	12 – 19	2.0	1 – 3

Notes:

1 – The range of percentages represents the range for the minimum and maximum wastewater projections. The higher percentages correlate to the minimum wastewater projection (i.e., when the wastewater flow rate is lower, then the concentrate would be a higher percentage of the final effluent) and the lower percentage correlates to the maximum wastewater projection (i.e., when the wastewater flow rate is higher, then the concentrate would be a higher percentage of the final effluent).

2 – RO concentrate in RWF final effluent is combined flows from both the new AWPF and the existing/expanded SVAWPC.

The maximum amount of concentrate calculated in the RWF final effluent is 19 percent, which is for year 2035 minimum wastewater projection (109 mgd) for maximum potable reuse (35,000 AFY) during summer conditions when NPR demands are highest. This is slightly higher than the 15 percent limit previously estimated that could be accommodated in the RWF final effluent without exceeding NPDES numerical limits. Therefore, the concentrate may require treatment in summer months if a full advanced treatment option is used in all satellite facilities in order to avoid permit non-compliance.

In order to provide source water for the satellite AWPFs in the SBWR system, the SVAWPC would have to be expanded to meet the additional demand.

Table 6D-6 summarizes the expanded RO production capacity of the SVAWPC required to meet this requirement.

Table 6D-6: Satellite Pathway SVAWPC Expansion (Disposal Option 1b)

Year	Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
	Expansion Required	Total Capacity	Expansion Required	Total Capacity	Expansion Required	Total Capacity
2025	8 mgd	16 mgd	8 mgd	16 mgd	4 mgd	12 mgd
2035	8 mgd	16 mgd	12 mgd	20 mgd	4 mgd	12 mgd

Notes:

1 – The current design production capacity of the SVAWPC is 8 mgd.

Table 6D-7 lists the advantages and disadvantages of this disposal option for the satellite pathway.

Table 6D-7: Advantages and Disadvantages for Existing SJ/SC RWF Outfall (Satellite Pathway) (Disposal Option 1b)

Advantages	Disadvantages
• Existing outfall with available capacity. • Local strategy within City's control.	☐ Risk of sporadic chronic toxicity incidences, which will be evaluated further by the City and SCVWD after the SVAWPC is in service. • High percentage of concentrate in RWF final effluent during year 2035, summer conditions with minimum wastewater projections. • Construction of long pipelines to convey concentrate to the outfall. • High O&M costs associated with pumping long distances. • Regulatory liability for regulatory infractions between the City and SCVWD. Sewer rate payers must be insulated from regulatory liability stemming from discharge. • Challenging institutional roles and responsibilities.

6D.2.2 Return for Treatment at SJ/SC RWF and SVAWPC (Disposal Options 2a and 2b)

If toxicity testing shows that the first disposal option of sending concentrate to the RWF final effluent causes chronic toxicity incidences, an alternative disposal option would be to return the concentrate to the RWF for primary/secondary treatment and additional treatment at the SVAWPC. This is the alternate concentrate disposal approach that will be adopted by the SVAWPC once it commences operations. The City has indicated that any disposal option that increases the TDS levels of the RWF final effluent would not be supported; however, the City would be open to allowing a pilot demonstration project to demonstrate that this disposal option does not impact the RWF wastewater treatment operation nor result in significant TDS increase in the final effluent or significant increases of individual dissolved constituents. Satellite and centralized pathways would approach this disposal option as described below.

6D.2.2.1 Centralized Facility (Disposal Option 2a)

Concentrate from a centralized AWPF would be pumped back to the RWF primary/secondary treatment. Under this disposal option, the concentrate would blend with wastewater and be treated at the RWF. A sidestream of secondary effluent would be treated at an expanded SVAWPC so that the blended recycled water in the SBWR system would still meet the salinity goals of 500 mg/L. While this would theoretically reduce the level of toxicity in the RWF effluent compared to sending concentrate directly to the outfall, concentrate return to the RWF would increase the TDS of the secondary effluent, which would in turn increase the TDS in the RWF final effluent. The TDS concentrations in the RWF for each treatment option were estimated using the flow balance (Attachment B) and then compared to the average incoming TDS of 720 mg/L. The increased TDS concentrations are summarized in Table 6D-8.

Table 6D-8: Centralized Pathway – TDS Concentrations in RWF Streams (Disposal Option 2a)

Year and Demand Assumptions	NPR Seasonal Demand	TDS Concentrations in RWF Influent [1]		
		Treatment Option 1 (MF + RO + UV)	Treatment Option 2 (MF + RO + AOP)	Treatment Option 3 (Ozone + BAC)
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	840 – 870	890 – 940	750 – 760
	Summer	900 – 950	960 – 1,040	790 – 810
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	830 – 860	940 – 1,040	750 – 760
	Summer	870 – 940	1,020 – 1,180	780 – 800

Notes:

1 – The range of TDS concentrations represents the range for the minimum and maximum wastewater projections. Currently, the average influent TDS is 720 mg/l.

Due to RO concentrate from both the SVAWPC and the centralized AWPF returning to the RWF, the SVAWPC would have to be expanded slightly in order to maintain the TDS concentration in the SBWR system at the required 500 mg/L. The increase in TDS concentration is not expected to affect the biological processes in the RWF. For example, the Camp Pendleton Southern Region Tertiary Treatment Plant has treated wastewater with a TDS concentration ranging from approximately 700 mg/L to 1,300 mg/L with no change in the performance of the activated sludge system.

The RO configurations at both the SVAWPC and centralized AWPF are projected to produce similar TDS concentrations in the RO permeate despite the increase of feed TDS concentrations to a maximum of 1,180 mg/L. Hence, the SVAWPC would only have to be expanded to account for the additional flows resulting from the concentrate returning to the RWF. Table 6D-9 summarizes the expanded RO production capacity of the SVAWPC required to meet this requirement.

Table 6D-9: Centralized Pathway SVAWPC Expansion (Disposal Option 2a)

Year	Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
	Expansion Required	Total Capacity	Expansion Required	Total Capacity	Expansion Required	Total Capacity
2025	3 mgd	11 mgd	4 mgd	12 mgd	1 mgd	9 mgd
2035	3 mgd	11 mgd	5 mgd	13 mgd	1 mgd	9 mgd

Notes:

1 – The current design production capacity of the SVAWPC is 8 mgd.

The percent of concentrate in the RWF final effluent would not be impacted by the SVAWPC or new AWPF because it is assumed that all concentrate from the existing and expanded SVAWPC and the AWPF would return to the RWF.

Table 6D-10 summarizes the amount of concentrate that is projected from both the SVAWPC and the centralized AWPF for this disposal method based on the maximum potable reuse demand assumptions.

Table 6D-10: Centralized Pathway – Amount of Concentrate Generated (Disposal Option 2a)

Year and Demand Assumptions	NPR Seasonal Demand	Amount of Concentrate as a percentage of RWF Final Effluent[1, 2]					
		Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
		mgd	%	mgd	%	mgd	%
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	3.4	4 – 5	4.5	5 – 7	1.0	1
	Summer	4.8	6 – 8	6.0	8 - 10	2.1	3
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	3.4	3 – 4	6.0	7 – 10	1.0	1
	Summer	4.8	5 – 8	7.8	10 – 16	2.1	2 – 3

Notes:

1 – The range of percentages represents the range for the minimum and maximum wastewater projections. The higher percentages correlate to the minimum wastewater projection (i.e., when the wastewater flow rate is lower, then the concentrate would be a higher percentage of the final effluent) and the lower percentage correlates to the maximum wastewater projection (i.e., when the wastewater flow rate is higher, then the concentrate would be a lower percentage of the final effluent).

2 – RO concentrate in RWF final effluent is combined flows from both the new AWPF and the existing/expanded SVAWPC.

It was previously estimated that up to 15 percent of concentrate could be accommodated in the RWF final effluent without permit impacts, excluding effluent toxicity considerations. The maximum amount of concentrate calculated in the RWF final effluent is 16 percent, which is for year 2035 minimum wastewater projection (109 mgd) for maximum potable reuse (35,000 AFY) during summer conditions when NPR demands are highest. Hence, the concentrate may potentially require treatment in summer months to avoid permit non-compliance.

Table 6D-11 lists the advantages and disadvantages of this disposal option for the centralized pathway.

Table 6D-11: Advantages and Disadvantages for Return for Treatment at SJ/SC RWF and SVAWPC (Centralized Pathway) (Disposal Option 2a)

Advantages	Disadvantages
• Existing RWF with treatment capacity (would need to be addressed with the RWF Capital Improvement Program). • May reduce toxicity levels in RWF effluent compared to sending concentrate directly to outfall. • Local strategy within City's control. • Simple operations. • Low capital and O&M costs.	☐ Increased TDS in RWF wastewater. ☐ Increased TDS in influent feed to SVAWPC and centralized AWPF. ☐ Need for expanded SVAWPC and centralized AWPF. ☐ Regulatory liability for regulatory infractions between the City and SCVWD. Sewer rate payers must be insulated from regulatory liability stemming from discharge. • Challenging institutional roles and responsibilities. • The City has indicated they do not support this option since it raises the TDS of the final RWF effluent.

6D.2.2.2 Satellite Facilities (Disposal Option 2b)

Instead of pumping concentrate through dedicated pipelines to the RWF, satellite AWPFs would utilize the existing sewer infrastructure in proximity to the respective facilities and discharge concentrate back to the RWF for treatment prior to discharge at the outfall.

Table 6D-12 summarizes the three proposed AWPF locations for the satellite pathway and the associated concentrate discharges.

Table 6D-12: Satellite Pathway Concentrate Discharges

Satellite Pathways	Coyote	Penitencia	Los Gatos
Proposed AWPF location (approx.)	(1) Monterey Rd & Blanchard Rd OR (2) Great Oaks Blvd & Highway 85	N Capitol Ave & Penitencia Creek Rd	Winchester Blvd & Hacienda Ave
Concentrate Flow Rate (mgd)	1.1 to 1.2	0.4 to 0.5	3.9 to 6.2

Notes:

1 – Discharges to sewer are aggregates of both RO concentrate and MF backwash waste flows.

By discharging concentrate to the local sanitary sewer system in the areas of the conceptual Coyote, Penitencia, and Los Gatos satellite facilities, respectively, concentrate streams can be returned to the RWF headworks and be treated at both the RWF and SVAWPC prior to final disposal or reuse. If there is insufficient sewer capacity at the satellite AWPF location, then a force main would need to be constructed to connect to a sewer location with sufficient capacity, or potentially all the way to the RWF. Returning concentrate to the SJ/SC RWF would also impact the SVAWPC sizing and operations.

The City has an industrial pre-treatment program that restricts the TDS concentration of waste discharges into their sewers. This concentrate management concept of discharging concentrate from satellite facilities into the sanitary sewers would require special approval by the City. If this was not allowed, then this option could not be considered further.

6D.2.2.3 Existing Sewer System Capacity

One concern with this disposal option is whether or not the nearest sewer system has available capacity to receive concentrate stream from the respective satellite AWPFs. Based on the anticipated concentrate flow rates summarized in Table 6D-12, a preliminary analysis was performed to evaluate sewer capacity for a continuous concentrate discharge (i.e., 24 hours a day, 7 days a week). The analysis considered the peak dry weather flow (PDWF) and peak wet weather flow (PWWF) conditions. The PDWF is based on future flow projections, while the PWWF is based on a 10-year 24-hour storm event.

At Penitencia, with a continuous maximum concentrate discharge flow rate of 0.5 mgd, approximately 6,500 linear feet (LF) of sewer pipeline would need to be constructed or upsized in order to reach a major trunk sewer. The major trunk sewer is a 36-inch pipe on Lundy Road, which would have sufficient capacity to receive the concentrate stream. The 6,500 LF of pipeline that needs to be replaced or upsized is based on the flow direction and layout of the existing local sewers. Some additional analysis is needed to determine if there is a more direct route to the trunk sewer. Additional analysis is also needed to size or upsize the connecting sewer.

At Coyote, two locations were considered as noted in Table 6D-12, the first one located nearer to Coyote Ponds and the second one closer to Ford Ponds. For the first location, there are already several sewer capacity deficiencies (some existing, some future) on the major trunk sewers downstream of this satellite AWPF location. Even if the City corrects these deficiencies, the additional concentrate flow would make a portion of it deficient again (about 6,700 LF). The existing trunk sewer is located on Santa Teresa Boulevard; a new pipeline would need to extend at least 3,000 LF to reach this trunk sewer. For the second location, a 1,800-LF force main could be installed to connect to an existing 18-inch sewer at Monterey and Flintwell. Alternatively, the force main could extend another 4,000 LF to connect to a 54-inch sewer at Monterey and Blossom Hill for greater capacity.

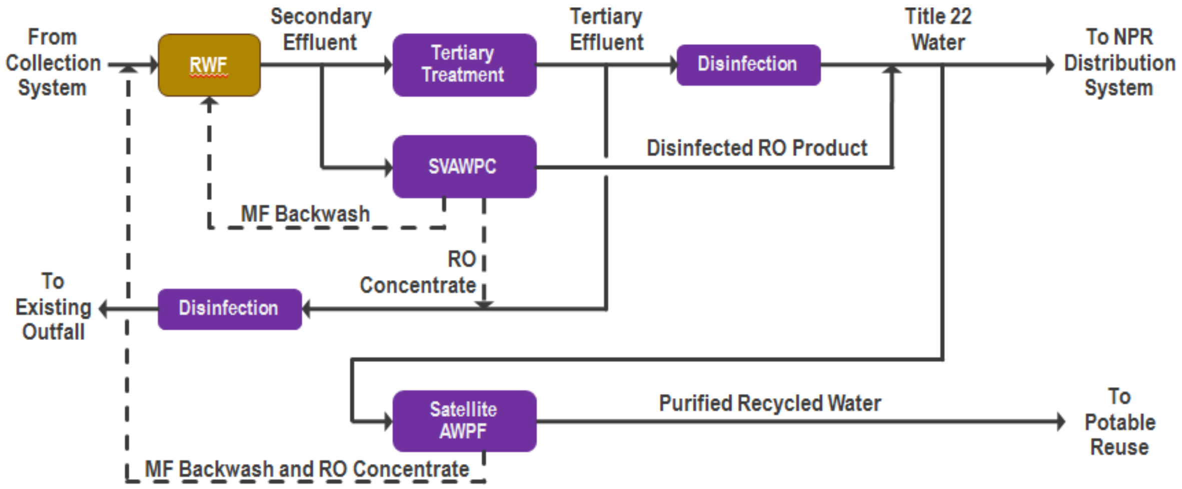
At Los Gatos, the maximum continuous flow is rather large, comparable to the wastewater that would be generated by a population of 100,000 people served by the collection system in that area. Addition of concentrate to the sewer system would affect two agencies: West Valley Sanitation District (WVSD) and the City of San José. Hence, there would need to be an institutional agreement between the City and WVSD that governs how much flow WVSD can discharge to the RWF. Within the City's system, there are already some downstream PDWF capacity deficiencies. If the City implements future projects to correct these deficiencies, there may be sufficient PDWF capacity within the City's system. However, during PWWF, the concentrate flow would cause several additional deficiencies in approximately 25,000 LF or more of deficient pipe just within the City's system. Additional analysis would be required to determine exactly the extent of pipeline that needs to be sized or upsized. Similarly, additional analysis would be required to determine potential downstream impacts within the WVSD system.

One potential strategy to alleviate deficiencies would be to shut down the AWPF(s) during wet weather events as long as PDWF capacity criteria are not exceeded. This would require additional analysis in the future and would require discussion with the City.

6D.2.2.4 Impacts to the SVAWPC (Disposal Option 2b)

The flow balance model calculates the percent of concentrate in the RWF final effluent and the TDS impacts to the RWF influent wastewater. Discharging concentrate for treatment at the SJ/SC RWF would increase the TDS concentration of the wastewater influent to RWF and would require expansion of the SVAWPC to keep the TDS at 500 mg/L in the SBWR distribution system. The flow schematic for the satellite pathway used for the flow balance is shown in Figure 6D-2. Additional information about the flow balance and the calculations are included in Attachment B.

Figure 6D-2: Schematic for Satellite Treatment Flow Balance (Disposal Option 2b)



The return of RO concentrate from satellite AWPFs to the RWF would increase the TDS of the RWF influent, which would in turn increase the TDS in the RWF final effluent. The TDS concentrations in the RWF for each treatment option were estimated using the flow balance (Attachment B) and then compared to the average incoming TDS of 720 mg/L. The increased TDS concentrations are summarized in Table 6D-13. Compared to the centralized pathway, the increase in TDS concentration for the satellite pathway is lower on average. This is likely due to the fact that the satellite AWPFs source feed water from the SBWR system, which has a TDS concentration of 500 mg/L (lower than the average RWF influent TDS concentration of 720 mg/L). It should be noted that TDS is used here to represent the general chemical composition of the water. Because RO removes nearly all dissolved constituents from the water, it should be anticipated that most individual dissolved constituents will increase proportionately with the TDS.

Table 6D-13: Satellite Pathway – TDS Concentrations in RWF Influent Stream (Disposal Option 2b)

Year and Demand Assumptions	NPR Seasonal Demand	TDS Concentrations in RWF Influent [1]		
		Treatment Option 1 (MF + RO + UV)	Treatment Option 2 (MF + RO + AOP)	Treatment Option 3 (Ozone + BAC) [2]
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	790 – 800	788 – 800	720
	Summer	790 – 800	788 – 800	720
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	780 – 800	800 – 830	720
	Summer	780 – 800	800 – 830	720

Notes:

1 – The range of TDS concentrations represents the range for the minimum and maximum wastewater projections. The average influent TDS is currently 720 mg/L.

The percent of concentrate from the SVAWPC in the RWF final effluent for the years 2025 and 2035 are summarized in Table 6D-14. These estimates are based on the maximum potable reuse demand assumptions.

Table 6D-14: Satellite Pathway – Amount Concentrate in RWF Final Effluent (Disposal Option 2b)

Year and Demand Assumptions	NPR Seasonal Demand	Amount of Concentrate in RWF Final Effluent [1, 2]					
		Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
		mgd	%	mgd	%	mgd	%
2025 PR: 25,000 AFY NPR: 15,000 AFY	Winter	6.5	3 – 4	6.5	3 – 4	1.2	1 – 2
	Summer	7.5	5 – 7	7.5	5 – 7	2.0	3
2035 PR: 35,000 AFY NPR: 15,000 AFY	Winter	6.5	2 – 4	8.7	4 – 6	1.2	1 – 2
	Summer	7.5	4 – 6	9.8	6 – 10	2.0	2 – 3

Notes:
1 – The range of percentages represents the range for the minimum and maximum wastewater projections. The higher percentages correlate to the minimum wastewater projection (i.e., when the wastewater flow rate is lower, then the concentrate would be a higher percentage of the final effluent) and the lower percentage correlates to the maximum wastewater projection (i.e., when the wastewater flow rate is higher, then the concentrate would be a lower percentage of the final effluent).
2 – RO concentrate in RWF final effluent is combined flows from both the new AWPF and the existing/expanded SVAWPC.

It was previously estimated that up to 15 percent of concentrate could be accommodated in the RWF final effluent without permit impacts, excluding effluent toxicity considerations. The maximum amount of concentrate calculated in the RWF final effluent is 10 percent, which is for year 2035 minimum wastewater projection (109 mgd) for maximum potable reuse (35,000 AFY) during summer conditions when NPR demands are highest. If the wastewater projections are lower than average, then the concentrate may require treatment in summer months to avoid permit non-compliance.

Due to the return of RO concentrate from the satellite AWPFs to the RWF, the SVAWPC would have to be expanded in order to maintain the TDS concentration in the SBWR system at the required 500 mg/L, including additional demand for the satellite AWPF feed water. The additional satellite AWPF source water demand results in a larger SVAWPC expansion compared to the centralized pathway. Table 6D-15 summarizes the expanded RO production capacity of the SVAWPC required to meet this requirement.

Table 6D-15: Satellite Pathway SVAWPC Expansion (Disposal Option 2b)

Year	Treatment Option 1 (MF + RO + UV)		Treatment Option 2 (MF + RO + AOP)		Treatment Option 3 (Ozone + BAC)	
	Expansion Required	Total Capacity	Expansion Required	Total Capacity	Expansion Required	Total Capacity
2025	12 mgd	20 mgd	12 mgd	20 mgd	4 mgd	12 mgd
2035	12 mgd	20 mgd	17 mgd	25 mgd	4 mgd	12 mgd

Notes:

1 – The current design production capacity of the SVAWPC is 8 mgd.

Table 6D-16 lists the advantages and disadvantages of this disposal option for the satellite pathway.

Table 6D-16: Advantages and Disadvantages for Return for Treatment at SJ/SC RWF and SVAWPC (Satellite Pathway) (Disposal Option 2b)

Advantages	Disadvantages
• Existing RWF with treatment capacity (needs to be incorporated in to the RWF Capital Improvement Program). • May have fewer potential toxicity issues in RWF effluent compared to discharging concentrate into the outfall • Use of existing infrastructure, only need pipeline from AWPF to nearest sewer with available capacity.	☐ Increased TDS in RWF influent wastewater. ☐ Increased TDS in influent feed to SVAWPC. ☐ Need for expanded SVAWPC. ☐ May not have adequate flow capacities in existing sewer systems. ☐ May require long pipeline constructions to reach sewer segment with available capacity. • Regulatory liability for regulatory infractions between the City and SCVWD. Sewer rate payers must be insulated from regulatory liability stemming from discharge. • Challenging institutional roles and responsibilities. • Significant engineering uncertainties • The City has indicated they do not support this option since it raises the TDS of the final RWF effluent.

6D.2.3 Existing Regional Deep Water Outfalls (Disposal Option 3)

The RWF, along with the wastewater treatment plants (WWTPs) for the Cities of Palo Alto and Sunnyvale, discharges to shallow waters of southern San Francisco Bay and does not receive a minimum initial dilution of 10:1. This means the RWF's NPDES permit effluent limitations are more stringent than those of facilities with deep water outfalls north of the Dumbarton Bridge. The two deep water outfalls closest to the RWF identified as potential disposal locations for concentrate generated by both centralized and satellite pathways are the Silicon Valley Clean Water (SVCW) (formerly known as South Bayside System Authority, name changed in February 2014) and East Bay Dischargers Authority (EBDA). Table 6D-17 provides a summary of each regional outfall based on its NPDES permit.

Table 6D-17: Regional Outfall Summary

Outfall	Discharge Limits[1]		Historical Flow			
	ADWF (mgd)	PWWF (mgd)	ADWF (mgd)	AWWF (mgd)	Average Flow (mgd)	Max Daily Flow (mgd)
SVCW[2]	29.0	71.0	NA	NA	15.9	48.8
EBDA[3]	107.8	189.1	56.7	65.3	61.1	87.6

Notes: ADWF = average dry weather flow; PWWF = peak wet weather flow; AWWF = average wet weather flow; NA = Not Available.
1 – Regional Water Quality Control Board, San Francisco Bay Region 2012a; Regional Water Quality Control Board, San Francisco Bay Region 2012b.
2 – Historical flow data from 2008 to 2011. Regional Water Quality Control Board, San Francisco Bay Region, 2012a.
3 – Historical flow data: RMC 2013.

6D.2.3.1 Potential Use of EBDA Outfall

Figure 6D-3 (centralized pathway) and Figure 6D-4 (satellite pathway) show several key facilities that are part of the EBDA system located along the eastern side of the Bay. EBDA has capacity in its dechlorination facility and outfall. The outfall capacity is 189.1 mgd (about 180 mgd at high tide). There are only 10-20 hours per year when EBDA's flow is above 150 mgd; the average flow over 2011-2013 was 61.1 mgd.

The concentrate connection would likely be treated like a direct connection, similar to EBDA's agreement with Livermore-Amador Valley Water Management Agency (LAVWMA). LAVWMA is charged for capital costs for repair and replacement, variable costs for chemicals and power based on flow, O&M for shared facilities, and pollutant loading.

Approximately three to five mgd of the treated wastewater flow from the Alvarado pump station (PS) goes to the East Bay Regional Parks Hayward Marsh. The remainder of the EBDA flow is discharged to the Bay through EBDA's deep water outfall. In both cases, EBDA is concerned with potential effects of the concentrate on toxicity, particularly with copper and ammonia toxicity. Additional analyses of potential toxicity impacts would be required for this disposal option.

There are two potential pipeline options for sending concentrate north to EBDA: through Union Sanitary District's (USD) raw sewage PS in Newark or through EBDA's Alvarado effluent PS in Union City. These two options are described below. Sub-Appendix C contains a summary of the meeting between EBDA, SCVWD, and the SBWR consultants.

One potential connection point for the RO concentrate is the USD's raw sewage PS in Newark. The potential route is shown on Figure 6D-3 and Figure 6D-4. An 18- to 24-inch diameter pipeline from the RWF to USD's Newark PS would be approximately 12 miles. For the centralized pathway, a new approximately 2-mile, 18- to 24-inch pipeline could be constructed along the existing right-of-way between the RWF and the City of Milpitas' wastewater PS, and then an approximately 10-mile pipeline would be constructed along the I-880 corridor between the vicinity of the Milpitas PS and USD's Newark PS for connection to the USD system. For the satellite pathway, up to 43 miles of additional pipelines would have to be built to connect each satellite facility to pipeline going north from Milpitas to USD. This alternative would require an agreement with USD for capacity in their plant.

There are two significant obstacles to this option. First, the concentrate would receive treatment through USD's WWTP. This would increase the TDS of the plant influent TDS and the concentrate would likely be treated as an industrial discharger, potentially with additional costs and pre-treatment requirements. This option would require an agreement between USD and the City and/or SCVWD for accepting the concentrate.

The second obstacle to this option is that USD would be unable to accommodate the additional flow within its capacity constraints in the EBDA system during peak wet weather events. USD reaches effluent conveyance capacity approximately 15-20 days per year. USD has a permitted average dry weather flow of 38 mgd and their current dry weather flow is 24 mgd, which means it has about 12 mgd of capacity available. Its allowed peak daily wet weather flow discharge into the EBDA outfall is 42.9 mgd, but in peak wet weather periods, USD flows may reach 90 mgd. During peak wet weather events, the AWPF would need to either shutdown or provide storage for one to two days.

Figure 6D-3: EBDA Regional Outfall Connection (Centralized Pathway) (Disposal Option 3)

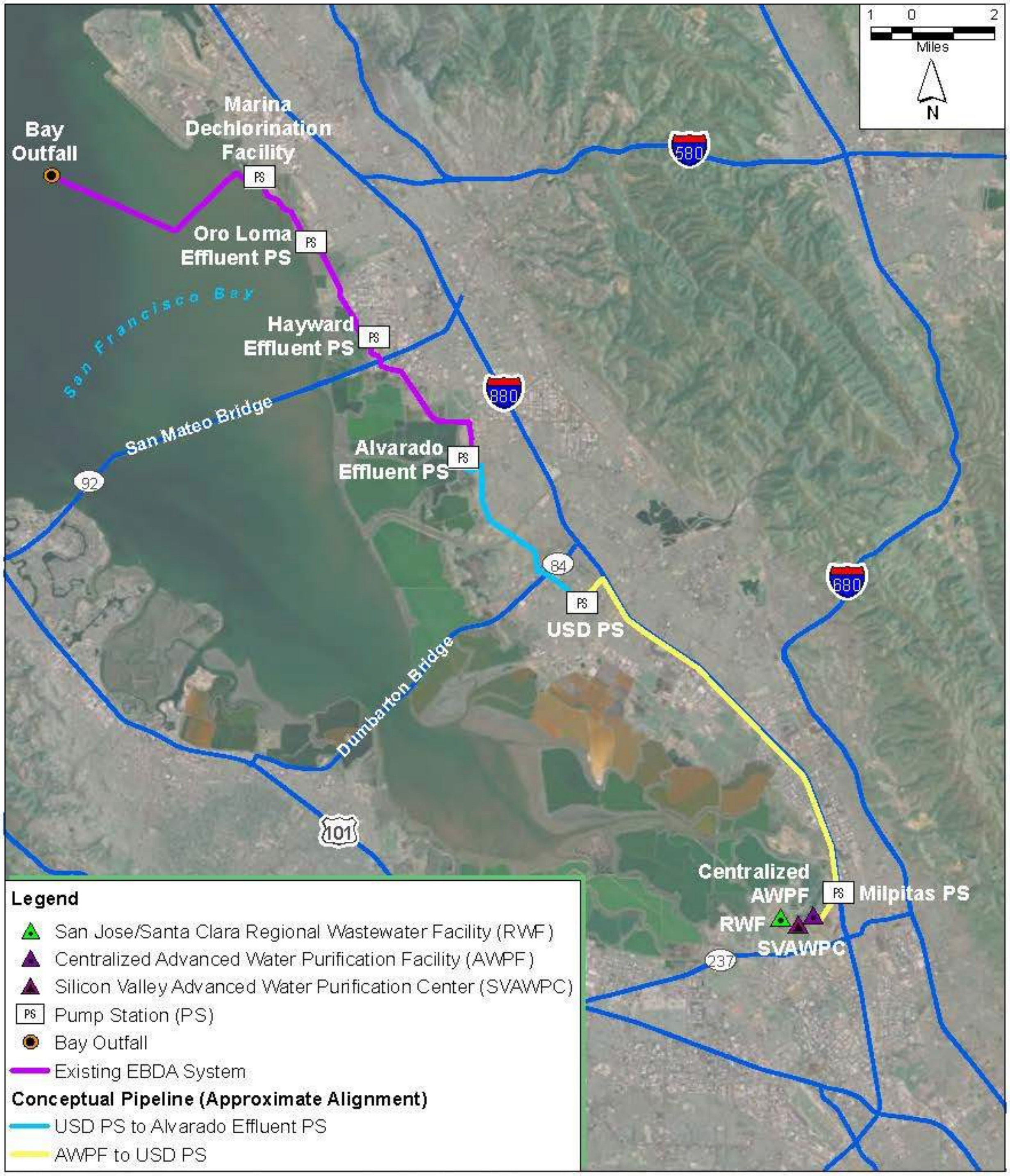
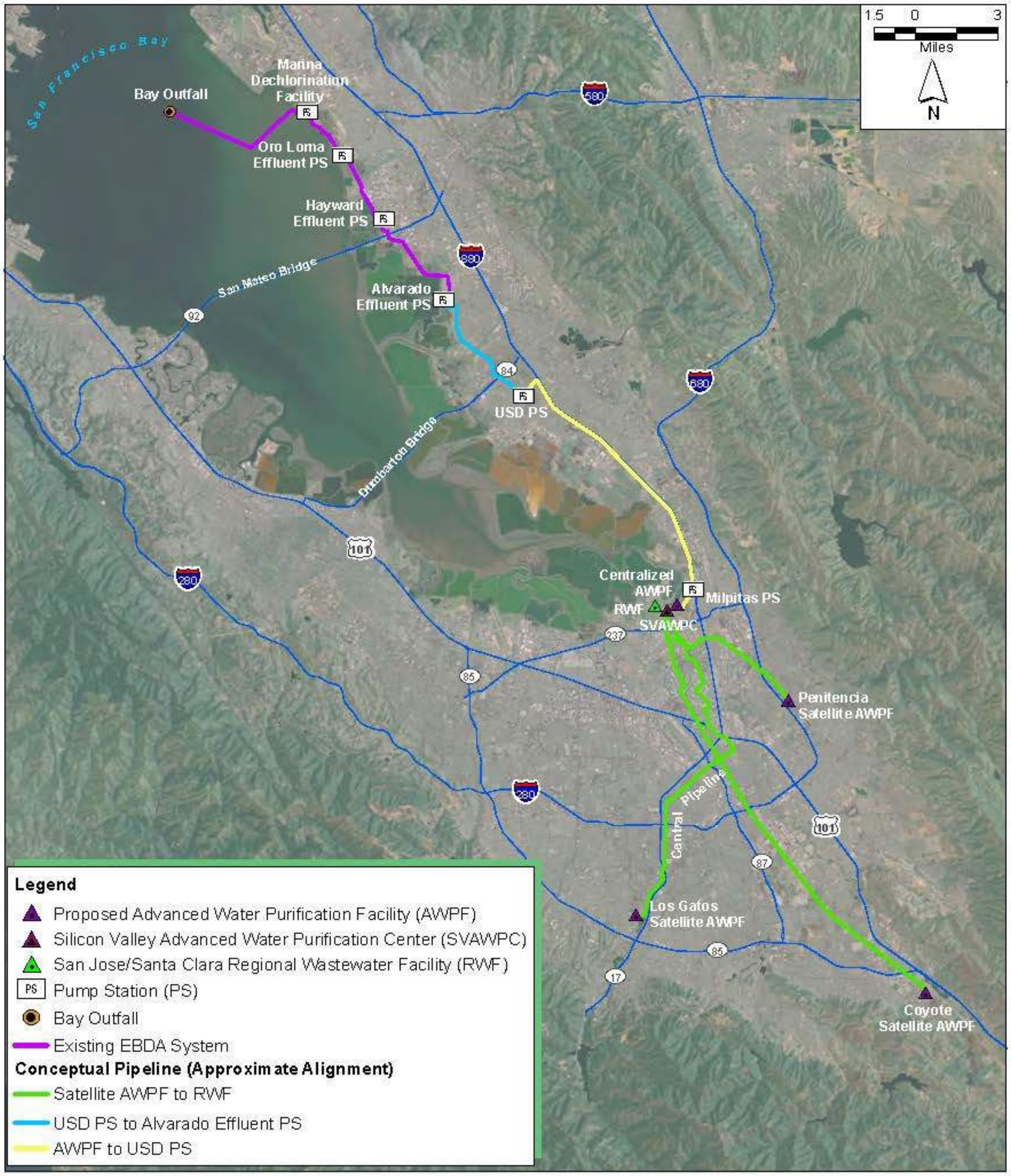

1 0 2
Miles
N
Bay Outfall
Marina Dechlorination Facility
PS
Oro Loma Effluent PS
San Francisco Bay
Hayward Effluent PS
San Mateo Bridge
92
580
880
Alvarado Effluent PS
84
USD PS
680
Dumbarton Bridge
101
Centralized AWPF
Milpitas PS
RWF
SVAWPC
237
Legend
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Centralized Advanced Water Purification Facility (AWPF)
Silicon Valley Advanced Water Purification Center (SVAWPC)
Pump Station (PS)
Bay Outfall
Existing EBDA System
Conceptual Pipeline (Approximate Alignment)
USD PS to Alvarado Effluent PS
AWPF to USD PS

Figure 6D-4: EBDA Regional Outfall Connection (Satellite Pathway) (Disposal Option 3)



The other option is to connect an RO concentrate pipeline to EBDA's Alvarado effluent PS in Union City, approximately 19 miles from the RWF. This additional alignment is shown in Figure 6D-3 and Figure 6D-4. This alternative would require an agreement with EBDA for capacity in their system. The most constrained portion of EBDA's system is the Alvarado PS and the pipeline capacity to Hayward, where the capacity is limited by the pipe size during peak wet weather flows. During peak wet weather events, an RO facility would need to either shutdown or provide storage for one to two days. The conceptual capital cost estimate for this disposal option is approximately $67M (centralized pathway).

6D.2.3.2 Potential Use of SVCW Outfall

Figure 6D-5 (centralized pathway) and Figure 6D-6 (satellite pathway) show several key facilities that are part of the SVCW system located along the western side of the Bay. The SVCW collection system does not have excess capacity to accept the concentrate flows. The SVCW WWTP uses equalization basins on peak wet weather days because of capacity issues. Concentrate would need to be piped directly to the SVCW outfall.

The SVCW outfall, located in Redwood City, is approximately 24 miles from the RWF as shown on Figure 6D-5 and Figure 6D-6. This construction would be challenging because the Highway 101 corridor is highly developed. The conceptual capital cost estimate for this disposal option is approximately $82M (centralized pathway).

SVCW has a deep water outfall with a maximum capacity of 160 mgd, twice the capacity of its WWTP. The concentrate pipeline could connect at the effluent of the WWTP after the effluent pumps. If the concentrate connection was before SVCW's NPDES permit compliance point, then it would be the blended flow (SVCW treated effluent and concentrate) that would be sampled for NPDES compliance. . If the connection was after SVCW's compliance point, the concentrate discharge would need its own NPDES permit and then pay SVCW for outfall capacity. The upstream connection point would incur an industrial waste discharge fee and monitoring costs; the downstream connection would incur a separate NPDES permit, outfall capacity fee, monitoring, reporting, and possibly more complicated pipeline connection. It would be easier and more cost-effective to have the concentrate be sampled as part of the blended effluent since the separate concentrate discharge could potentially have difficulty meeting some of the NPDES limits.

Attachment D contains a summary of the meeting between SVCW, SCVWD, and the SBWR consultants.

6D.2.3.3 Disposal Option 3 Summary

Table 6D-18 lists the advantages and disadvantages of these regional outfall disposal options.

Table 6D-18: Advantages and Disadvantages for Existing Regional Deep Water Outfalls (Disposal Option 3)

Advantages	Disadvantages
• Available capacity in regional outfalls. • Outfalls are located in deep water north of the Dumbarton Bridge with higher dilution ratios for effluent standards than shallow water outfalls.	☐ High capital costs to construct pipelines to convey concentrate from the centralized AWPF to either EBDA (approximately 12 to 19 miles) or SVCW (approximately 24 miles). Additional pipelines would be required for the satellite pathway to convey concentrate from the remote plant AWPFs. • High O&M costs associated with pumping long distances. • Permit requirements, environmental studies, and right-of-way acquisitions needed for pipeline alignments through highly developed highway corridors. • Requires agreement with outside agencies, providing less local control. • Concentrate quality concerns, toxicity for EBDA and salinity for SVCW, may pose regulatory issues for discharge.

Figure 6D-5: SVCW Regional Outfall Connection (Centralized Pathway) (Disposal Option 3)

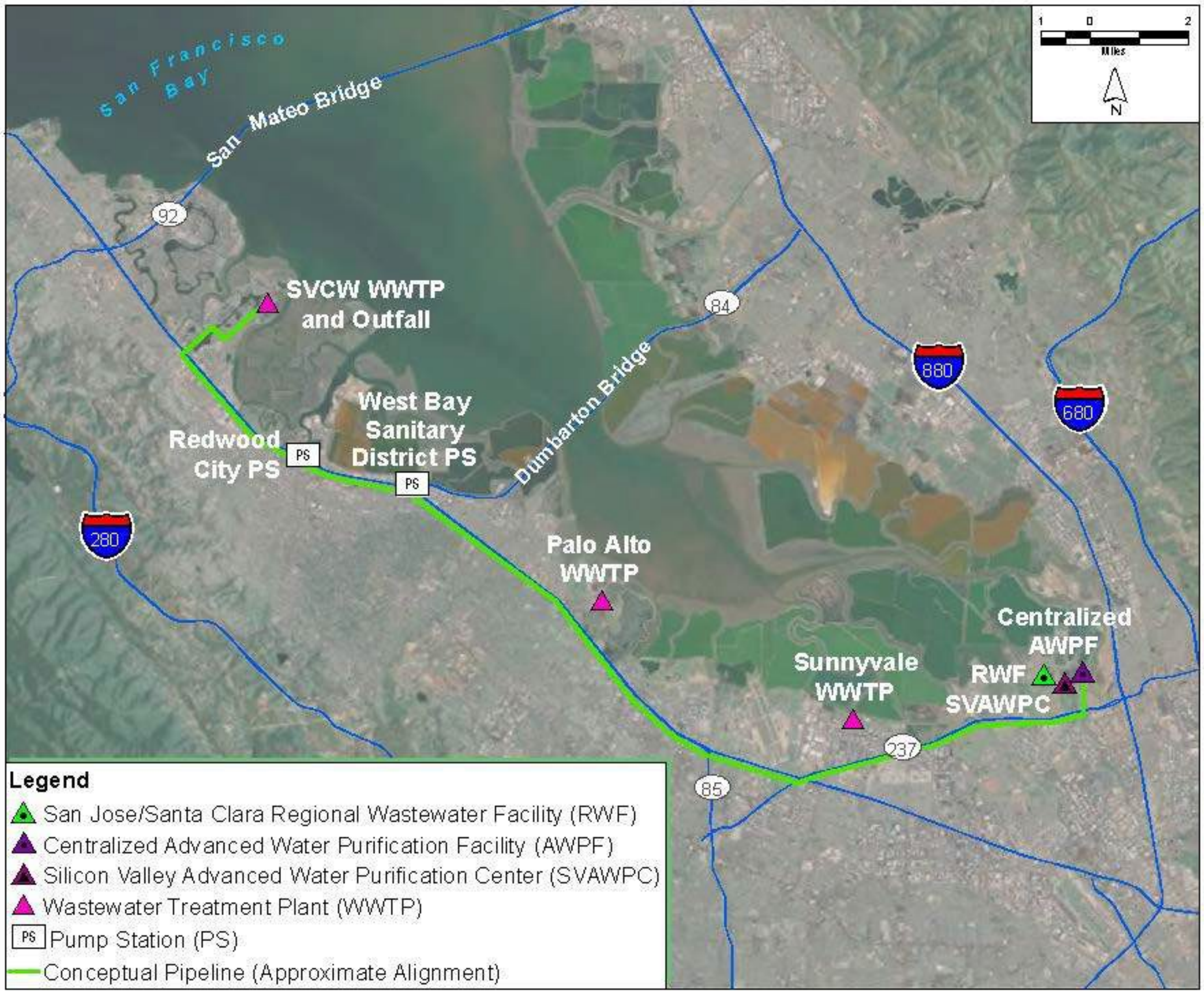
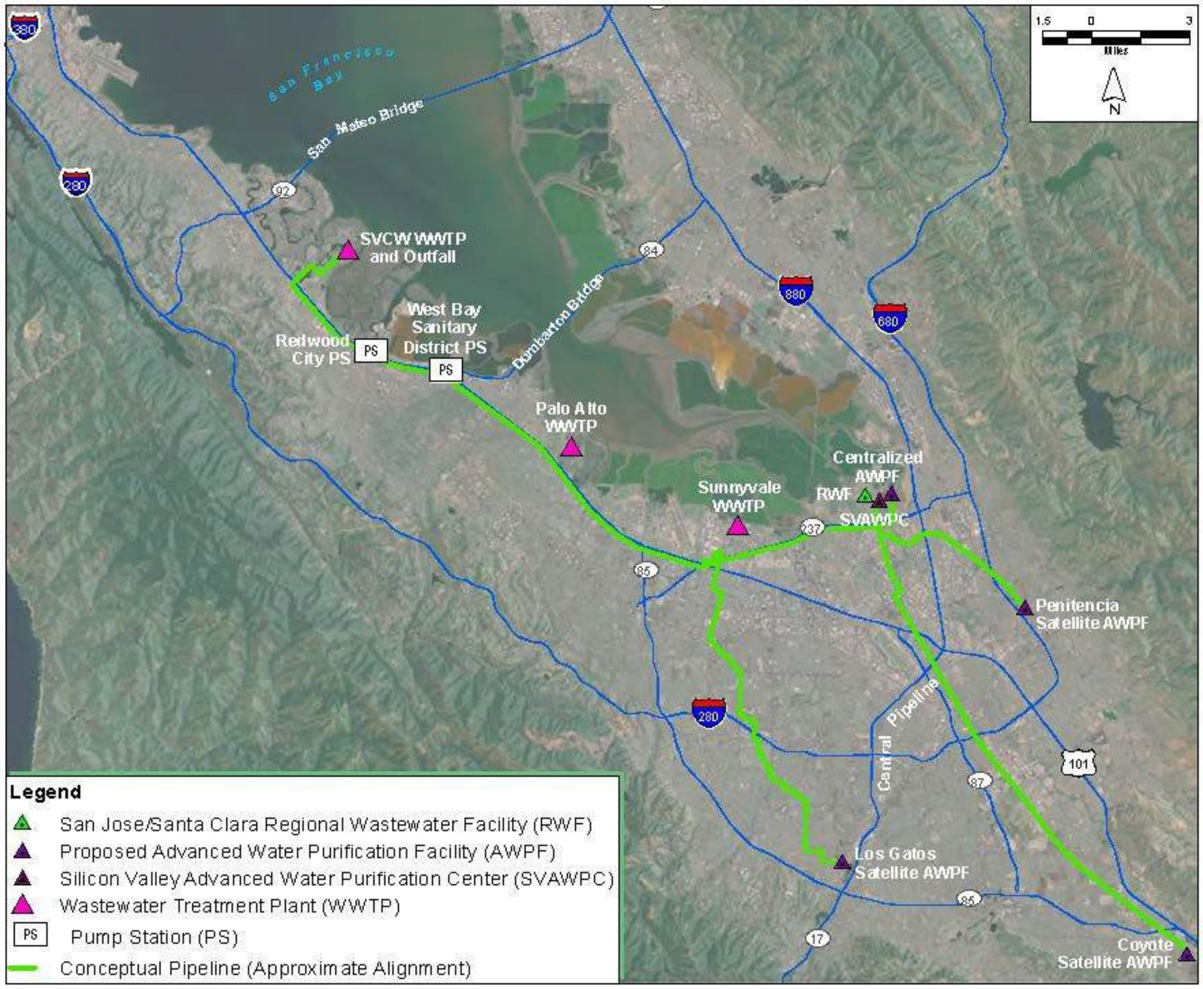

San Francisco Bay
San Mateo Bridge
92
SVCW WWTP and Outfall
84
Dumbarton Bridge
880
680
West Bay Sanitary District PS
Redwood City PS
PS
PS
280
Palo Alto WWTP
Sunnyvale WWTP
Centralized AWPF
RWF
SVAWPC
237
85
1 0 2
Miles
N
Legend
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Centralized Advanced Water Purification Facility (AWPF)
Silicon Valley Advanced Water Purification Center (SVAWPC)
Wastewater Treatment Plant (WWTP)
Pump Station (PS)
Conceptual Pipeline (Approximate Alignment)

Figure 6D-6: SVCW Regional Outfall Connection (Satellite Pathway) (Disposal Option 3)


1.5 0 3
Miles
N
San Francisco Bay
San Mateo Bridge
Dumbarton Bridge
380
280
92
84
880
680
237
85
101
87
17
SVCW WWTP and Outfall
West Bay Sanitary District PS
Redwood City PS
PS
Palo Alto WWTP
Sunnyvale WWTP
Centralized AWPF
RWF
SVAWPC
Penitencia Satellite AWPF
Central Pipeline
Los Gatos Satellite AWPF
Coyote Satellite AWPF
Legend
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Proposed Advanced Water Purification Facility (AWPF)
Silicon Valley Advanced Water Purification Center (SVAWPC)
Wastewater Treatment Plant (WWTP)
PS Pump Station (PS)
Conceptual Pipeline (Approximate Alignment)

6D.2.4 Existing Regional Shallow Water Outfall (Disposal Option 4)

The City of Sunnyvale's Water Pollution Control Plant (WPCP) discharges to shallow waters of southern San Francisco Bay, as does the RWF, and has more stringent NPDES permit effluent limitations than WWTPs north of the Dumbarton Bridge. The WPCP's treated wastewater flows into Moffett Channel, tributary to Guadalupe Slough. The two discharge locations are about six miles apart. The WPCP's discharge enters San Francisco Bay about a mile from where the RWF's discharge enters, so their discharge situations are quite similar. The WPCP has an ADWF capacity of 29.5 mgd and PWWF capacity of 40 mgd. From 2006 through 2008, the plant's ADWF was 9.4 mgd and the total average flow was 11.8 mgd (Regional Water Quality Control Board, San Francisco Bay Region 2009a).

In early 2013 Sunnyvale and SCVWD evaluated purified water alternatives. The analysis identified alternatives with RO treatment that would produce 4.3 to 6.8 mgd of blended RO concentrate and secondary treated wastewater for discharge through the WPCP's outfall into the Bay. The TMs discussed possible effects of ammonia and dibromochloromethane concentrations in the RO concentrate, but did not discuss toxicity.

However, Sunnyvale is now going through a new wastewater plant master planning process and plans to construct a new WWTP by 2018. The use of membrane bioreactors (MBR) may be used for secondary treatment and filtration, which could potentially also be used as pretreatment for RO.

The Sunnyvale WPCP's average flow discharged to Guadalupe Slough is 11.8 mgd. If the AWPF RO concentrate was added to the Sunnyvale WPCP discharge, the estimated 2.0 to 5.9 mgd of AWPF RO concentrate could be 17.5 to 38.6 percent of the combined flow of ADWF. The percentage of RO concentrate would increase even further if increased reuse by Sunnyvale is taken into account.

A pipeline of approximately 6 miles from a centralized AWPF would need to be constructed to convey the concentrate from a centralized AWPF near the RWF to the Sunnyvale outfall. The conceptual capital cost estimate for this disposal option is approximately $25M (centralized pathway).

Table 6D-19 lists the advantages and disadvantages of this disposal option.

Table 6D-19: Advantages and Disadvantages for Existing Regional Shallow Water Outfall (Disposal Option 4)

Advantages	Disadvantages
• Closer proximity to RWF than the regional deep water outfall options (EBDA and SVCW), which will decrease pipeline construction costs.	□ Shallow water discharge similar to RWF. □ Future plans for treatment facilities are under revision. □ AWPF RO concentrate would make up large percentage of total discharge which may affect ability to meet NPDES limits, especially if Sunnyvale implements a potable reuse project. • No capacity if Sunnyvale decides to recycle most of their water. • Challenging institutional roles and responsibilities.

6D.2.5 New Outfall North of Dumbarton Bridge (Disposal Option 5)

Another disposal option would be to construct a new deep water outfall for discharge of the concentrate to San Francisco Bay. It is assumed that the new outfall would be located north of the Dumbarton Bridge where the concentrate would be able to discharge into a part of San Francisco Bay where a deep shipping channel is located near Redwood City so that the outfall would be classified as a deep water discharge and be eligible for dilution credits. Table 6D-20 provides a sample comparison between effluent limits for EBDA's deep water outfall north of Dumbarton Bridge versus the RWF's shallow water outfall south of Dumbarton Bridge.

Table 6D-20: Comparison of Effluent Limits North and South of the Dumbarton Bridge

Parameter/ Pollutants	Units	EBDA[1] Average Monthly Effluent Limit (AMEL)	EBDA Maximum Daily Effluent Limit (MDEL)	SJ/SC RWF[2] AMEL	SJ/SC RFW MDEL
Ammonia	mg/L as N	93	130	3	8
Copper	µg/L	53	78	11	19
Cyanide	µg/L	21	42	5.7	14
Nickel	µg/L	79	160	25	33

Notes:

1 – The EBDA outfall is located north of the Dumbarton Bridge and is eligible for dilution credits. Regional Water Quality Control Board, San Francisco Bay Region, 2012b.

2 – The SJ/SC outfall is located south of the Dumbarton Bridge. Regional Water Quality Control Board, San Francisco Bay Region, 2003.

3 – All values are average monthly limits.

As mentioned, one possibility is to locate the new deep water outfall within the Redwood City shipping channel north of the Dumbarton Bridge. There are two ways to deliver concentrate to this location: overland or under the bay. An overland option would involve a pipeline alignment similar to that required to send concentrate to the SVCW outfall. Challenges include acquiring easements and right-of-way for the pipeline and the significant distance from the AWPF to the potential outfall location. An alternative would be to run it under the Bay via horizontal direct drilling (HDD). This method would be shorter and more direct than constructing a pipeline overland. The conceptual capital cost estimate for this disposal option is approximately $80M. HDD under a body of water such as SF Bay would actually be more complicated and would have to consider additional cost elements such as dewatering. From a regulatory perspective, an under-the-bay pipeline would require an easement or encroachment permits, environmental clearance (CEQA/NEPA), resource agency permits, and an NPDES permit.

Table 6D-21 lists the advantages and disadvantages of this disposal option.

Table 6D-21: Advantages and Disadvantages for New Outfall North of Dumbarton Bridge (Disposal Option 5)

Advantages	Disadvantages
• Would not affect RWF current discharge permit compliance. • Deep water outfall eligible for dilution credits. • Possibly fewer toxicity test requirements. • No institutional impediments since SCVWD would obtain its own permit.	☐ High capital costs to construct pipelines from centralized and satellite locations to the new outfall. A separate concentrate outfall was previously determined infeasible due to high construction costs. ☐ Permit requirements, environmental studies, and right-of-way acquisitions needed for pipeline alignments. • High cost of HDD from the RWF to the new outfall. Additional complexities for HDD construction under the bay, e.g. dewatering. • Higher O&M costs due to pumping long distances. • Regulatory process of getting a new outfall will be complex. • No potential location currently identified.

6D.2.6 New Outfall to Coyote Point (Disposal Option 6)

An alternative disposal option to a new outfall north of the Dumbarton Bridge would be to discharge at a new outfall at Coyote Point, which is located south of Dumbarton Bridge. This potential outfall location was suggested by the City based on the South Bay Dilution Study (Final Report, September 1990), which evaluated the dilution of effluent from the RWF. As expected, the observed minimum average water column dilutions increase with distance from the RWF. At Coyote Point, the average dilution was observed to be 10 to 1.

Table 6D-22 shows how the discharge of 100 percent concentrate at Coyote Point may or may not have compliance issues with estimated NPDES permit effluent limits. It is expected that a 10:1 dilution credit for toxic constituents (i.e. priority pollutants) would be granted for a permitted discharge at this location. As such, the only toxic constituent with a potential issue (at 10:1 dilution) is cyanide. Since cyanide might decay through an MF-RO process, there is some uncertainty for the maximum value that would actually be observed. In addition, cyanide would certainly decay in the water body (unlike copper or nickel, for instance), so if needed some dispensation might be able to be negotiated with the Regional Water Board that adjusts the use of the 10:1 dilution factor in order to have compliance feasibility. More precise information on cyanide in the concentrate can be gleaned from the performance of the SVAWPC that came online in March 2014.

Table 6D-22: Estimated NPDES Compliance for Concentrate Discharge at Coyote Point (Disposal Option 6)

	Constituent	Unit	Type of Limit	Estimated RO Feed Conc. (1)	Estimated Brine Conc. (1)	Technology-Based Effluent Limit	Estimated Water Quality-Based Effluent Limit (2)		
							No Dilution	5:1 Dilution	10:1 Dilution
Conventional and Non-Conventional Constituents	5-Day Biochemical Oxygen Demand (BOD5) (3)	mg/L	Avg Monthly	2.7	18	10 or 30	--	--	--
		mg/L	Max Daily	3.5	23	20 or 45	--	--	--
	Total Suspended Solids (TSS)	mg/L	Avg Monthly	12 (MF/RO Feed)	0.0085	10	--	--	--
		mg/L	Max Daily	15 (MF/RO Feed)	0.010	20	--	--	--
	Turbidity (4)	NTU	Instantaneous Max	19 (MF/RO Feed)	0.013	10	--	--	--
	Total Ammonia	mg/L	Avg Monthly	1.7	12	3	2	7	13
		mg/L	Max Daily	2.7	18	8	4	18	36
Detected Toxic Priority Constituents	Metals and Cyanide:								
	Antimony	µg/L	None	0.58	3.9	*No limit expected (5)*			
	Arsenic	µg/L	None	1.8	12	*No limit expected (5)*			
	Cadmium	µg/L	None	0.15	1	*No limit expected (5)*			
	Chromium, Total	µg/L	None	1.1	7.4	*No limit expected (5)*			
	Copper	µg/L	Avg Monthly	4.6	31	--	12	28	48
		µg/L	Max Daily	5.5	37	--	17	40	69
	Lead	µg/L	None	2.6	18	*No limit expected (5)*			
	Mercury	µg/L	Avg Monthly	0.0027	0.018	*Load-based limits in the mercury and PCBs watershed permit*			
		µg/L	Avg Weekly	0.0035	0.023				
	Nickel	µg/L	Avg Monthly	8	53	--	26	68	122
		µg/L	Max Daily	8.8	59	--	32	85	151
	Selenium	µg/L	None	0.67	4.5	*No limit expected (5)*			
	Silver	µg/L	None	0.11	0.73	*No limit expected (5)*			
	Thallium	µg/L	None	0.39	2.6	*No limit expected (5)*			
	Zinc	µg/L	Avg Monthly	28	188	--	129	579	1141
		µg/L	Max Daily	32	213	--	161	719	1416
	Cyanide (6)	µg/L	Avg Monthly	3.7	24	--	3	10	20

	Constituent	Unit	Type of Limit	Estimated RO Feed Conc. (1)	Estimated Brine Conc. (1)	Technology-Based Effluent Limit	Estimated Water Quality-Based Effluent Limit (2)		
							No Dilution	5:1 Dilution	10:1 Dilution
		µg/L	Max Daily	4.9	32	--	4	18	35
	Organic Constituents:								
	Bromoform	µg/L	None	0.004 (7)	0.027 (7)	*No limit expected (5)*			
	Chlorodibromomethane	µg/L	Avg Monthly	14	94	--	34	170	339
		µg/L	Max Daily			--	68	341	681
	Chloroform	µg/L	None	35	240	*No limit expected (5)*			
	Dichlorobromomethane	µg/L	Avg Monthly	20	136	--	46	230	460
		µg/L	Max Daily			--	92	461	922
	1,3-Dichloropropylene	µg/L	None	0.52 (7)	3.5 (7)	*No limit expected (5)*			
	Methylene Chloride	µg/L	None	0.47 (7)	3.2 (7)	*No limit expected (5)*			
	Toluene	µg/L	None	0.9	6.1	*No limit expected (5)*			
	Bis (2-Ethylhexyl) Phthalate	µg/L	Avg Monthly	1.6 (7)	11(7)	--	5.9	10	16
		µg/L	Max Daily			--	12	21	32
	Dibenzo (a,h) Anthracene	µg/L	Avg Monthly	0.011 (7)	0.074 (7)	--	0.049	(8)	
		µg/L	Max Daily			--	0.098		
	Indeno (1,2,3-cd) Pyrene	µg/L	Avg Monthly	0.009 (7)	0.061 (7)	--	0.049	(8)	
		µg/L	Max Daily			--	0.098		

Notes:

Water quality-based effluent limit calculations were performed in accordance to the 2005 Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.

Green indicates compliance is feasible with the estimated limit or no limit is expected.

Yellow indicates compliance is possible if higher effluent limit for deep water dischargers is applied.

Red indicates there is a potential compliance issue.

1 – These values are based on 95th and 99th percentile concentration values (on a lognormal basis) from data collected from June 2009 through August 2013, and they are compared with the average monthly and maximum daily effluent limits, respectively. For constituents with no current limit and/or a small data set, the values are based on maximum values.

2 – Estimated limits may differ from current NPDES permit due to the use of different data sets.

3 – It is typical for particulate BOD (about half of the BOD) to be removed in the microfiltration process. To estimate the RO feed concentration for BOD, tertiary data were halved to represent an approximation of the soluble BOD entering the system. The higher effluent limit of 45 mg/L for deep water dischargers is an average weekly effluent limit (not maximum daily).

4 – Turbidity was assumed to be proportional to the total suspended solids (TSS).

5 – An effluent limit is not expected (this pollutant did not show reasonable potential).

6 – The calculations for cyanide used a data set that excluded an 8.4 µg/L data point sampled on March 1, 2012 to reduce the influence of this particularly high value.

7 – This value was estimated using a maximum effluent concentration with the DNQ (detected, not quantifiable) data qualifier, indicating that this value is uncertain.

8 – The Regional Water Board (Region 2) does not permit dilution credits and mixing zones for bioaccumulative pollutants.

In addition, for BOD if the higher limits normally issued to deep water dischargers (30/45) were used for a Coyote Point NPDES permit, then compliance is feasible. Compliance would not be feasible for BOD limits if they were the same as in the existing RWF NPDES permit (10/20).

Figure 6D-7 shows a potential pipeline alignment from a centralized AWPF to the Coyote Point outfall. Conceptual capital cost estimate for this disposal options is approximately $30M. Table 6D-23 lists the advantages and disadvantages of this disposal option.

Figure 6D-7: Connection to Coyote Point Outfall (Disposal Option 6)

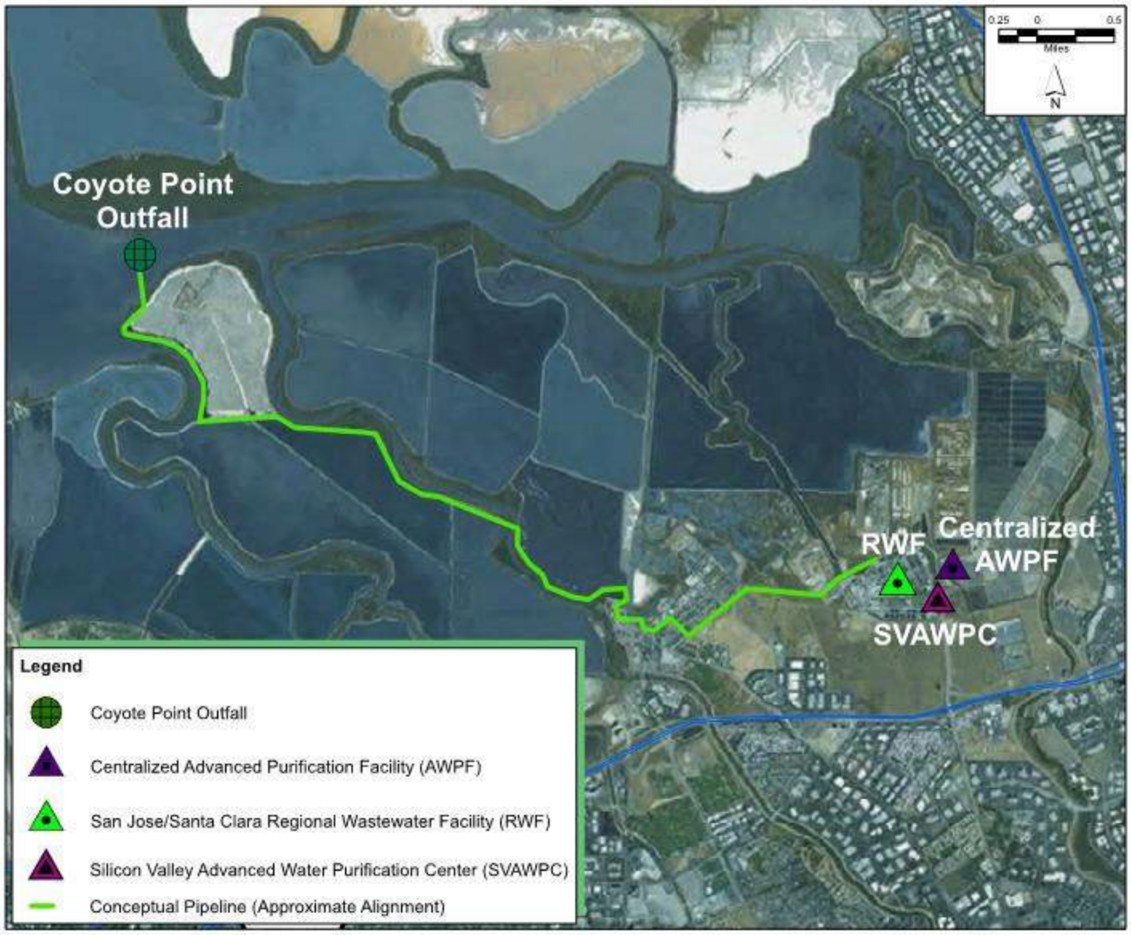

0.25
0
0.5
Miles
N
Coyote Point Outfall
RWF
Centralized AWPF
SVAWPC
Legend
Coyote Point Outfall
Centralized Advanced Purification Facility (AWPF)
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Silicon Valley Advanced Water Purification Center (SVAWPC)
Conceptual Pipeline (Approximate Alignment)

Table 6D-23: Advantages and Disadvantages for New Outfall to Coyote Point (Disposal Option 6)

Advantages	Disadvantages
• 10:1 dilution available at Coyote Point. • Proximity to the RWF. • Would not affect RWF current discharge permit compliance. • No institutional impediments since SCVWD would obtain its own permit. • Possibly fewer toxicity test requirements.	☐ Uncertainty over compliance of cyanide and BOD with estimated NPDES permit effluent limits. ☐ Feasibility of outfall pipeline alignment through existing salt marches. ☐ Permit requirements, environmental studies, and right-of-way acquisitions needed for pipeline alignments.

6D.2.7 Evaporation Ponds (Disposal Option 7)

Evaporation ponds as a method of concentrate disposal has been used at many small existing RO facilities, typically in desert locations. Evaporation ponds use solar energy to heat and evaporate water from concentrate solutions, depositing precipitated salts on the pond floor. This form of treatment is advantageous in areas where evaporation rates are high and land is relatively inexpensive.

Evaporation ponds can be suitable for small RO facilities in rural areas with available land. Depending on the land requirements and the amount of land available, it may be necessary to minimize the concentrate volume before sending it to an evaporation basin. As flows of concentrate increase, the expense of disposal through evaporation ponds typically increases due to the need for additional land.

Mechanical equipment can be used to increase the evaporation rate. There are two general types of equipment: sprayer/misters (semi-enhanced evaporation) and water cannons (enhanced evaporation). Both types of equipment spray concentrate into the air to increase the evaporation rate, but the semi-enhanced evaporation equipment is not as intrusive as the enhanced evaporation equipment. Vendors cite evaporation rates of two to ten times the evaporation rate for the semi-enhanced evaporation equipment and up to 30 times the evaporation rate for enhanced evaporation. Wind can cause carryover with both types of evaporation equipment requiring additional space around the evaporation ponds or turning equipment off during windy events. It is assumed that semi-enhanced evaporation may be appropriate for use at an evaporation pond in the southern San Francisco Bay, but that enhanced evaporation would not be considered due to public perception issues.

Cost drivers for evaporation ponds include the local evaporation rate and rainfall, the concentrate volume, land and earthwork costs, liner costs, and the salinity of the concentrate, which determines the useful life of the ponds. The largest individual cost is frequently the synthetic liner cost, where double layers are required for permitting. Monitoring wells are also likely to be required for meeting the permit requirements. Evaporation ponds are relatively easy to construct, easy to maintain, and have low operational costs, where operational costs mostly comprise of pumping of concentrate flows to ponds. However, evaporation ponds have to have the solids removed and transported to a landfill once storage capacity has been reached. Evaporation is most efficient for water with low salt concentrations with the effective evaporation rate decreasing as the salinity increases.

Table 6D-24 lists the design parameters and assumptions that were used to estimate the size of evaporation ponds required for RO concentrate generated from the new AWPF(s) and the expanded portion of the SVAWPC. It is assumed that the concentrate flow rate generated by the existing SVAWPC (1.2 mgd) would continue to be discharged to the existing outfall and not sent to the evaporation ponds.

Table 6D-24: Design Parameters for Evaporation Ponds (Disposal Option 7)

Design Parameter	Value
Pan evaporation rate (in) [1]	50.9
Pan evaporation correction factor	0.7
Salinity factor	0.7
Annual precipitation (in) [2]	15.0
RO recovery rate	85% and 92.5%

Notes:
1 – Average Annual Pan Evaporation Rate is for Oakland, CA from the California Climate Data Archive, http://www.calclim.dri.edu/ccda/comparative/avgpan.html
2 – Average annual precipitation data for San José, 1982 and 2012 (Annual Climatological Summary, National Oceanic and Atmospheric Administration)

The area required for evaporation pond was estimated for a range of concentrate flows for the potable reuse alternatives to demonstrate the minimum, average, and maximum land areas that would be required for evaporation. The range of concentrate flows does not include the concentrate flow from the existing SVAWPC (1.2 mgd of concentrate), which is assumed to be discharged to the RWF chlorine contact basins. The concentrate flows are associated with the following combination of pathways and treatment options:

- Minimum concentrate flow = Pathway 1 Option 1, which is 2.0 mgd
- Average concentrate flow = Pathway 1 Option 2, which is 5.8 mgd
- Maximum concentrate flow = Pathway 2 Option 2, which is 8.8 mgd

Table 6D-25 provides a summary of the estimated evaporation pond sizes based on the two RO recovery rates identified in Table 6D-24 and assuming both standard and semi-enhanced evaporation.

Table 6D-25: Estimated Evaporation Pond Sizes (Disposal Option 7)

Evaporation Method	Evaporation Pond Size Required (acres) based on Concentrate Flow					
	RO Recovery Rate = 85%			RO Recovery Rate = 92.5%		
	Min [1] 2.0 mgd	Avg [2] 5.8 mgd	Max [3] 8.8 mgd	Min [1] 0.9 mgd	Avg [2] 2.7 mgd	Max [3] 4.1 mgd
Standard	2,880	8,340	12,660	1,330	3,840	5,830
Semi-Enhanced	460	1,320	2,000	210	610	920

Notes:

1 – Minimum concentrate flow rate assumes a Pathway 1 (centralized) MF-RO facility without AOP, which would limit GWR to recharge ponds. This assumes no expansion required for the SVAWPC and therefore no additional concentrate flows.

2 - Average concentrate flow rate assumes a Pathway 1 (centralized) full advanced treatment facility. This assumes no expansion required for the SVAWPC and therefore no additional concentrate flows.

3 – Maximum concentrate flow rate assumes Pathway 2 (satellite) full advanced treatment facilities including additional concentrate flows from an expanded SVAWPC.

The current and planned land use at the SJ/SC RWF based on the Plant Master Plan (Draft, March 2012) are shown in Figure 6D-8 and Figure 6D-9, respectively. Based on the planned land uses, there are no viable areas large enough to accommodate evaporation ponds for the potable reuse pathways. Pond A18 is a former Cargill Salt production pond which was purchased by the City in 2005 as a buffer area for the RWF. The City has allowed circulation of Bay waters through the pond to improve water quality.

The SCVWD owns Pond A4, a former salt evaporation pond, which is located in Sunnyvale located adjacent to and north of the Sunnyvale WPCP (see Figure 6D-10). Pond A4 is 330 acres and has managed salt water recirculation through the pond. Based on discussions with SCVWD, the pond has been identified by the US Fish and Wildlife Service to be restored in the future to tidal wetlands and be connected to the Bay. The Tidal Marsh Ecosystem Recovery Plan has designated Pond A4 as near-term tidal restoration areas. If the future plans for the pond change, then Pond A4 could potentially be considered for an evaporation pond. The Sunnyvale WPCP includes 440 acres of oxidation ponds. However, Sunnyvale is now going through a master planning process and has indicated that a portion of the oxidation ponds (up to 300 acres) may be available for other uses between 2026 and 2030, depending on the master planning decisions that are presently being evaluated and finalized. This additional area could be used in conjunction with Pond A4 to increase the potential evaporation pond acreage to 630 acres, which may accommodate a semi-enhanced system treating concentrate from a high RO recovery AWPF (see Table 6D-25). However, one significant barrier to the use of Pond A4 or other similar ponds is the Title 27 regulations for lined ponds, one of which mandates that the bottom of an evaporation pond must maintain at least 5 feet of separation from the groundwater level. Since Pond A4 is part of the bay, a 5-foot separation from groundwater could not be achieved and this disposal option is technically infeasible. Alternatively, the area could also be used as a partial concentrate disposal method (i.e., some concentrate managed through evaporation and some concentrate managed through another concentrate management option) for all combinations of potable reuse pathways and treatment options.

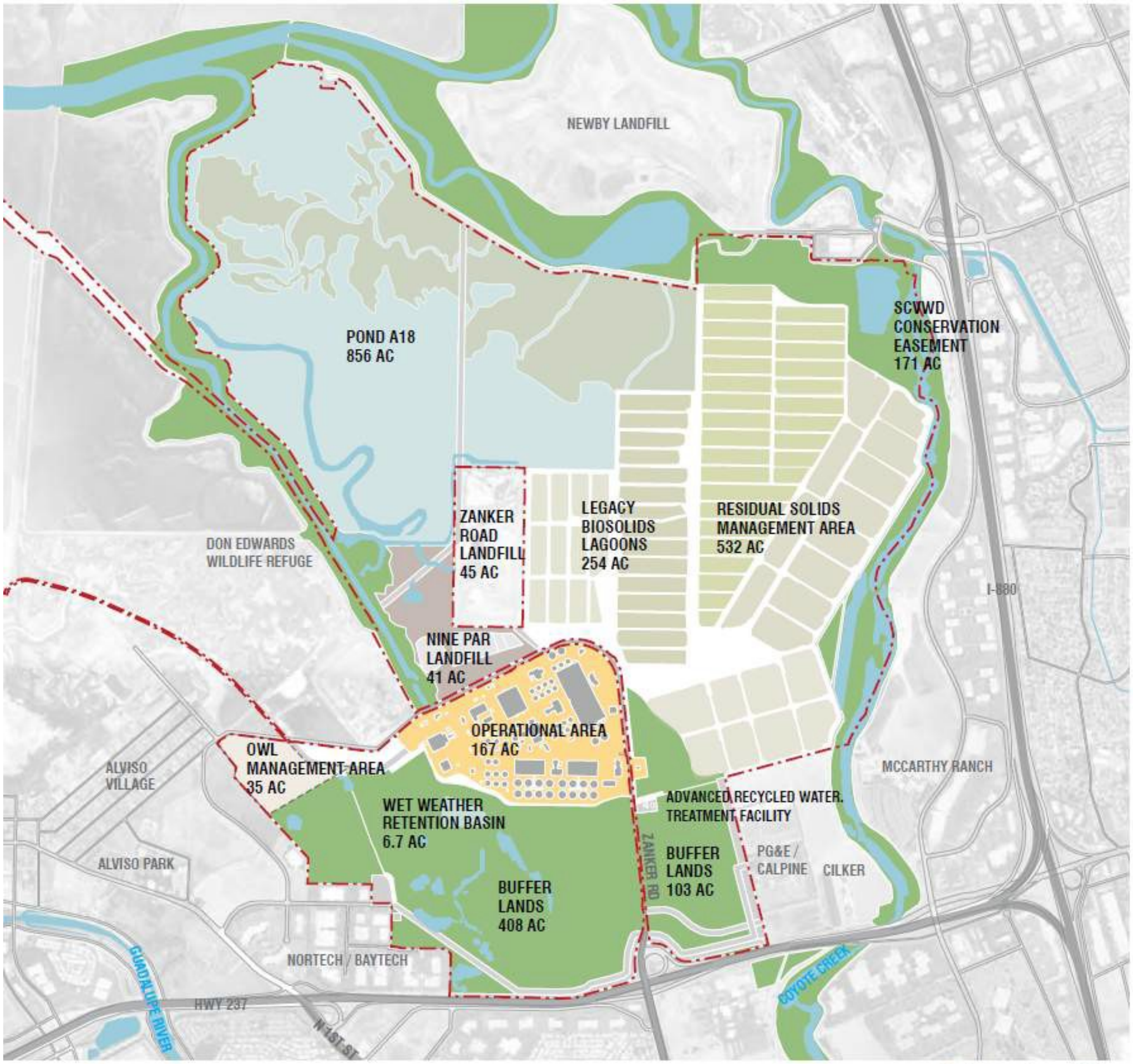
Based on information from the Sunnyvale master planning, the existing berms on the oxidation ponds will need to be reconstructed. Additionally, the available acreage of the ponds would be reduced with exterior berms and interior berms to create subponds and access roads. If this disposal option is to be pursued further, then the actual space available would need to be analyzed in greater detail and refined evaporation calculations would need to be prepared.

Table 6D-26 lists the advantages and disadvantages of this disposal option.

Table 6D-26: Advantages and Disadvantages for Evaporation Ponds (Disposal Option 7)

Advantages	Disadvantages
• Low capital costs if land is available. • Simple operations, low level of complexity. • Use of solar energy is a passive and cost-efficient method. • Low O&M costs.	□ Requires significant land area, which is not available near the RWF. □ Loss of evaporated water. □ Additional disposal of crystallized salts required. • Salt must be excavated and removed periodically without damaging pond lining system. • Aesthetics and neighborhood impacts. • Consideration must be given to the type of salts generated and if the salts from the ponds would be considered hazardous due to lead or copper or other constituents. • Costs would be high for large land acquisition and distribution piping.

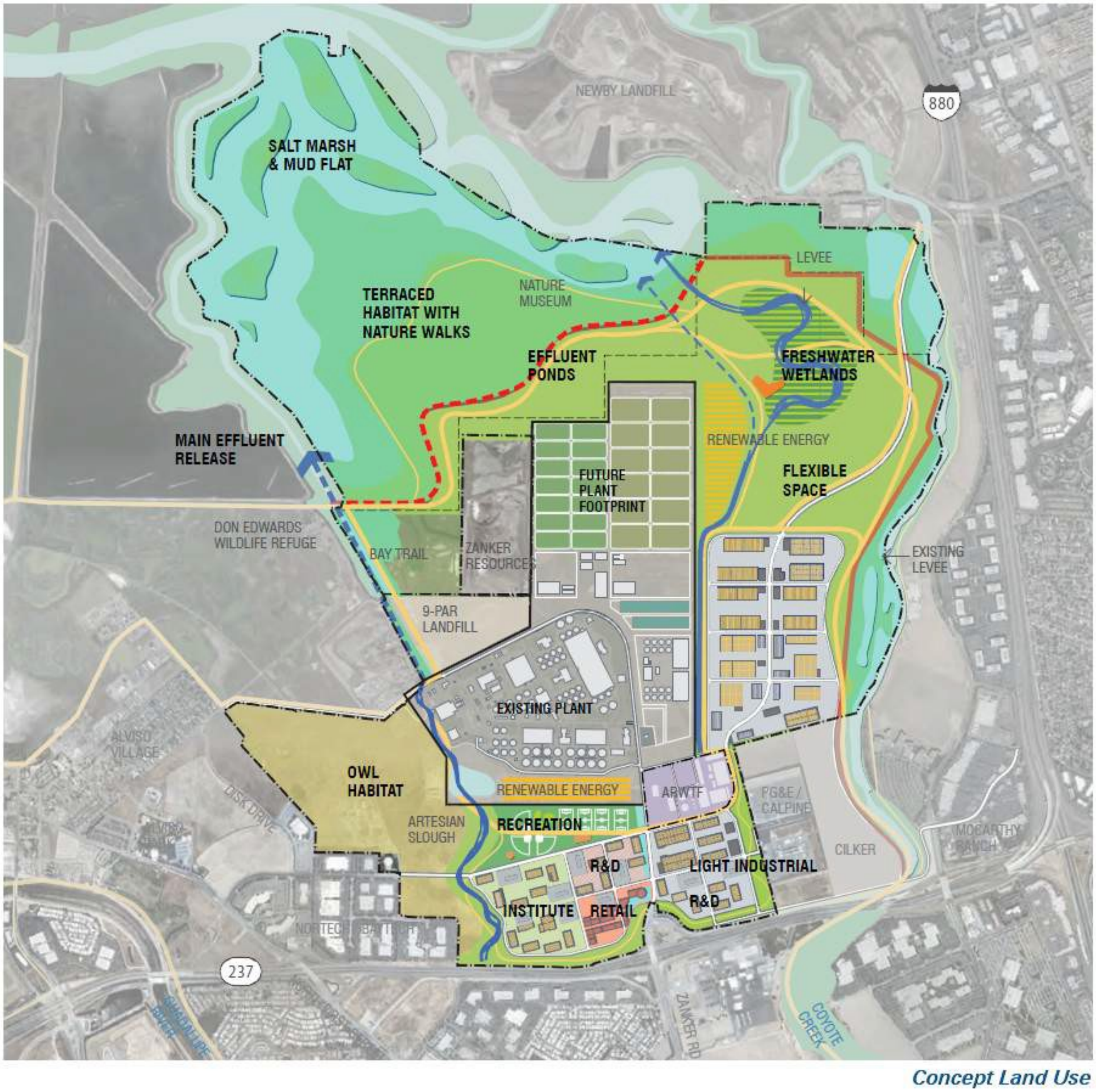
Figure 6D-8: Existing SJ/SC RWF Land Uses



Existing Land Uses

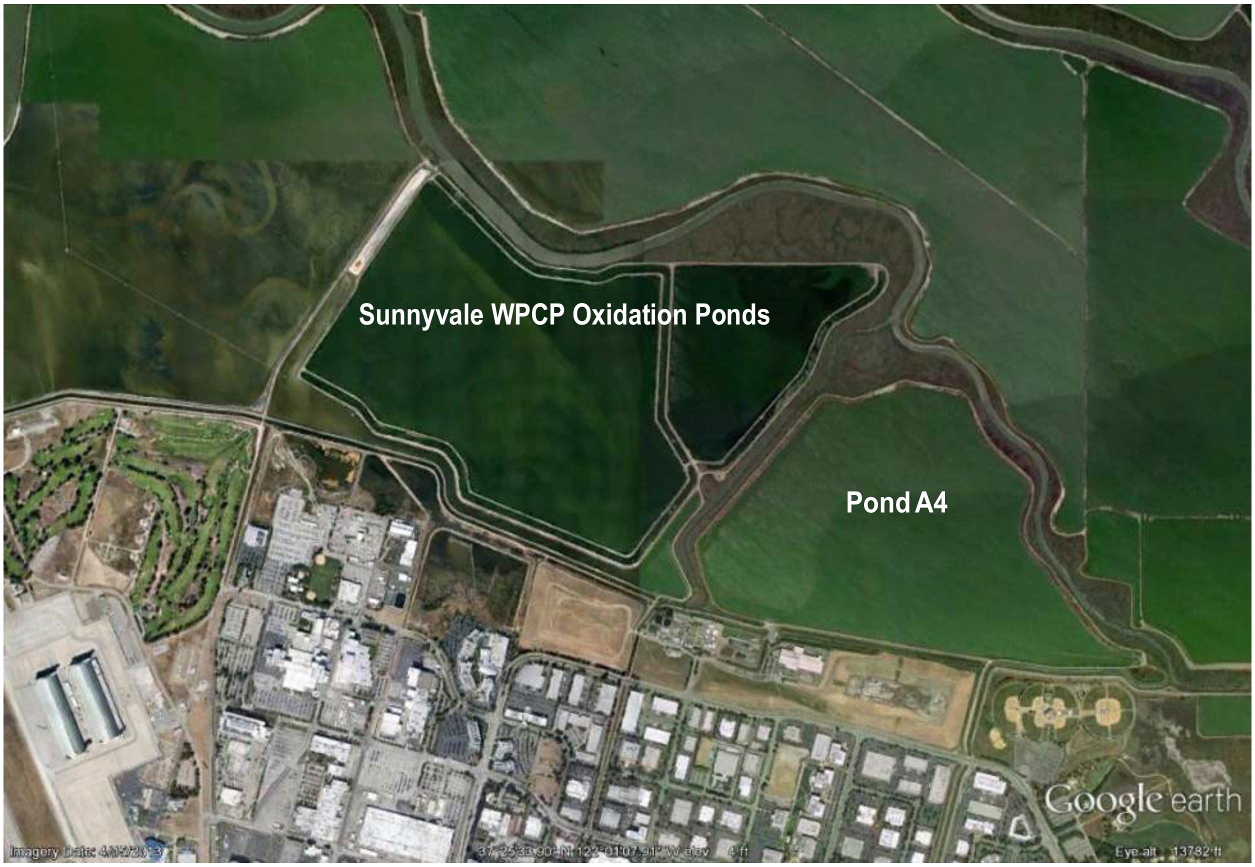
Source: Plant Master Plan (Draft, March 2012)

Figure 6D-9: Proposed 30-year Planning Horizon Concept Land Uses for SJ/SC RWF



Source: Plant Master Plan (Draft, March 2012)

Figure 6D-10: Locations of Alternative Pond Options (Disposal Option 7)


Sunnyvale WPCP Oxidation Ponds
Pond A4
Google earth
37°25'33.90" N 122°01'07.91" W elev 4 ft
Eye alt 13782 ft

6D.2.8 Engineered Wetlands (Disposal Option 8)

Engineered fresh and brackish water wetlands increase the TDS concentration of the RO concentrate while reducing the concentration of nutrients and trace contaminants in RO concentrate. The soils and plants in engineered wetlands can reduce dissolved organic carbon and nitrogen, ammonia and phosphorus through biological activity and adsorption. The wetlands also result in increased evapo-transpiration that effectively increases the salinity of the effluent. The City of Oxnard, California, performed several pilot studies between 2003 and 2009 to determine the feasibility of using treatment wetlands as a mechanism for treating RO concentrate with the goal of using the effluent as source water for coastal wetland restoration. Two different source waters were used for these pilot studies: the Phase 1 study used RO concentrate from desalting brackish groundwater, while the Phase 2 study used RO concentrate from advanced purification of secondary effluent at the City of Oxnard's WWTP.

Key findings from these pilot studies indicated that brackish marsh plant species grow normally in RO concentrate while passively removing contaminants such as nitrate-nitrogen, selenium, and other metal pollutants. The Phase 2 study showed significant mass removal rates for nitrate (75%), nitrite (51%), total nitrogen (48%) and limited reductions for total organic carbon (TOC) (9%), selenium (36%), and calcium (7%). WET testing conducted by the City of Oxnard showed decreases for both acute and chronic toxicity to indicator organisms. The engineered wetlands enhanced the evapo-transpiration rate to reduce the overall volume of concentrate, where the final TDS concentration in the effluent is projected to fall within a range of 15,000 to 25,000 mg/L, which could possibly serve as source water to support restoration of tidal wetlands.

The example from the City of Oxnard was used as a basis to estimate the potential size of engineered wetlands required to treat the range of RO concentrate anticipated from the potable reuse pathways. The Oxnard Phase 2 pilot study demonstrated the importance of hydraulic retention time (HRT) as the key operational control over wetland performance, where the full-scale wetland system would be designed to have a HRT as short as seven days or as long as forty days. Table 6D-27 provides the range of engineered wetlands sizes that can be expected based on this recommended HRT range and the minimum, average, and maximum RO concentrate flows that can be anticipated from the potable reuse pathways.

Table 6D-27: Estimated Engineered Wetlands Sizes (Disposal Option 8)

HRT (days)	Engineered Wetlands Size Required (acres) based on Concentrate Flow					
	RO Recovery Rate = 85%			RO Recovery Rate = 92.5%		
	Min 2.0 mgd	Avg 5.8 mgd	Max 8.8 mgd	Min 0.9 mgd	Avg 2.7 mgd	Max 4.1 mgd
7	22	64	97	10	29	45
40	126	365	554	58	168	255

Notes:

1 – Estimated wetlands sizes assume an average wetland depth of 3 ft and average wetlands porosity of 65 percent. Wetland porosity is defined as fraction of total volume available through which water can flow.

Based on Table 6D-27, assuming a higher HRT of 40 days, the conservative estimate for sizing engineered wetlands is 63 acres per 1 mgd of RO concentrate. Conceptual capital cost estimate for this disposal can run up to approximately $10M per mgd of flow. Considering a range of concentrate flow between 2.0 mgd and 5.8 mgd, engineered wetlands costs can range between $20M and $88M. If this concentrate treatment option is pursued, a pilot study would be required to define site specific design parameters such as water quality, climate, and vegetation. The specific HRT would depend on water quality targets for the wetlands effluent and the type of treatment wetlands installed. The preferred siting location would be at the existing Pond A18, which is located north of the SJ/SC RWF and owned by the City of San José. Pond A18 currently covers 856 acres (Figure 6D-8).

While engineered wetlands provide beneficial treatment to RO concentrate, treated effluent from the engineered wetlands would have to be conveyed to another location for ultimate disposal. One alternative would be to use the treated effluent for tidal wetlands restoration. Many of the ponds north and west of the RWF are part of the South Bay Salt Pond Restoration Project, which is restoring over 15,000 acres of former tidal wetlands (salt water marsh) in the South Bay. The salt ponds are former Cargill Salt production ponds acquired in 2003 by the State of California and the federal government, and are currently full of seawater at various degrees of concentration from 35 parts per trillion (ppt) to 290 ppt of salinity. As a result of the elevated concentration of salts in the basins, wetlands habitat has not developed even after active salt production has stopped. The restoration project is being managed as a joint project with the California State Coastal Conservancy, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, SCVWD, Alameda County Flood Control and Water Conservation District, and U.S. Army Corps of Engineers.

The overall goal of the restoration project is to recreate a natural tidal system to flush concentrated brine associated with the previous production of salt from the ponds using natural tidal flows. Untreated RO concentrate has a lower salinity than desired for development of a natural salt water marsh; the lower TDS concentration of the concentrate would result in brackish water marsh similar to the marsh that develops where fresh water discharges to the bay. To develop a natural salt water marsh the TDS concentration of the RO concentrate from either the centralized or satellite pathways would need to be increased from the 3,100-4,500 mg/L range to a range of 27,000-35,000 mg/L by treating the concentrate with engineered wetlands. The viability of constructing engineered wetlands in Pond A18 to aid tidal wetlands restoration would have to be further evaluated against both the 30-year plan (Figure 6D-9) and the South Bay Salt Pond Restoration Project.

An alternative siting location for the engineered wetlands would be at the Sunnyvale WPCP Oxidation Ponds and Pond A4. However, these ponds are located further away from the RWF and would require longer conveyance pipelines and associated pumping. Additionally, in order to discharge treated effluent from the engineered wetlands to natural tidal wetlands, a new NPDES permit would be required. Alternatively, the treated effluent could be returned to the RWF final effluent, which may potentially help to mitigate future incidences of chronic toxicity in the existing RWF outfall while eschewing the need for a new NPDES discharge permit.

Table 6D-28 lists the advantages and disadvantages of this disposal option.

Table 6D-28: Advantages and Disadvantages of Engineered Wetlands (Disposal Option 8)

Advantages	Disadvantages
• Proximity to RWF (Pond A18). • Improved water quality of engineered wetlands effluent. • Engineered wetlands reduce volume of concentrate through evapo-transpiration. • Engineered wetlands create tidal habitat. • Potentially help to mitigate chronic toxicity if combined with RWF final effluent. • Passive/low-energy requirements if located at Pond A18. • Potential resource agency partnership. • Contribution to salt pond restoration.	☐ Need to obtain a new NPDES permit in order to discharge into restored tidal wetlands. ☐ Salt water marsh restoration typically uses natural tidal flow to restore wetlands. ☐ Periodic engineered wetlands maintenance, e.g. structural inspections, vector management, and vegetation management.

6D.2.9 Existing Salt Ponds (Disposal Option 9)

Another regional disposal option would be to send concentrate to an existing salt pond. Cargill operates two salt pond locations in Newark and Redwood City. For this option, it is assumed that concentrate could potentially be sent to the Cargill salt ponds in Newark as they are closer to the AWPF than the ponds in Redwood City. The salt ponds are basically large evaporation ponds that generate salt for commercial applications, e.g., food-grade salt and roadway clearing salt. Figure 6D-11 shows the location of the Cargill Salt Ponds in relation to the SJ/SC RWF and a conceptual alignment for a dedicated concentrate pipeline that would have to be constructed for either the centralized or satellite pathways to convey concentrate flows to the Cargill salt ponds.

Cargill's overall salt production is constant. The company pumps Bay water into their evaporation ponds between May and October at rates of up to 90,000 gpm using three pumps each rated at 30,000 gpm. Tidal influences limit when they can pump on a daily basis. The key factor limiting production is the evaporation rate. A pipeline is presently in use for transfer of salt water between their Newark and Redwood City facilities.

While disposing of concentrate to the Cargill salt pond could be considered a beneficial reuse of the precipitated salts, two main concerns for this disposal option are intake availability and water quality. Typical salt pond operations include periods where there is no intake of salt water, i.e., November to April, to preserve production with the seasonal drop off in evaporation rates. This seasonal shutdown would disrupt the ability to accept concentrate from an AWPF, and a backup disposal location would be needed during the salt pond downtimes. Also, there may be reservations by Cargill to accept concentrate from an advanced wastewater facility since the salt product would be marketed for human consumption. Cargill is selective in their operations with the tendency to withdraw water with the highest salt concentrations as this speeds their process. Cargill has received similar proposals in the past to potentially accept concentrate streams, but the differing water quality of concentrate compared to Bay water is something that they would likely not accept. Bay source water near the Cargill salt ponds has salt concentrations of 27,000-35,000 mg/L, whereas concentrate from either the centralized or satellite pathway would have salt concentrations in the 3,100-4,500 mg/L range. These lower salt concentrations could hinder the efficiency of Cargill's operation.

Figure 6D-11: Cargill Salt Ponds Disposal Concept (Disposal Option 9)

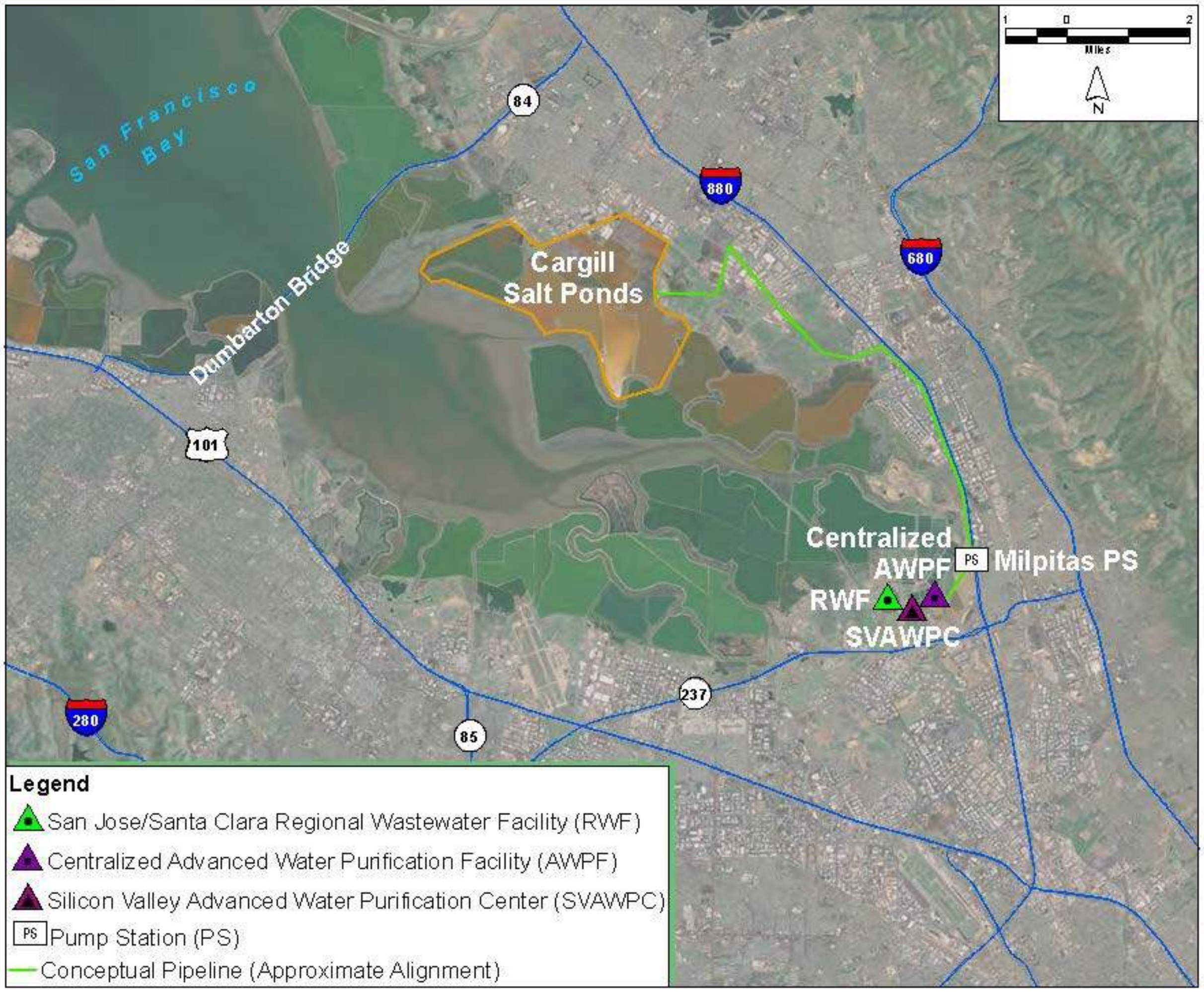

1
0
2
Miles
N
San Francisco Bay
84
880
680
Dumbarton Bridge
Cargill Salt Ponds
101
Centralized AWPF
PS
Milpitas PS
RWF
SVAWPC
237
85
280
Legend
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Centralized Advanced Water Purification Facility (AWPF)
Silicon Valley Advanced Water Purification Center (SVAWPC)
PS Pump Station (PS)
Conceptual Pipeline (Approximate Alignment)

Table 6D-29 lists the advantages and disadvantages of this disposal option.

Table 6D-29: Advantages and Disadvantages of Existing Salt Ponds (Disposal Option 9)

Advantages	Disadvantages
• Beneficial use of concentrate.	☐ Salt ponds periodically shut down intake of salt water. • Lower salt concentrate compared to Bay source water used by Cargill which is disadvantageous to Cargill operation. • Unlikely acceptance of concentrate stream due to food-grade salts products. • Requires a backup concentrate management option when Cargill is not taking in saltwater. • Complex roles, responsibilities, and liability relationships.

6D.2.10 Deep Well Injection (Disposal Option 10)

Deep well injection is also a potential disposal option. Deep injection wells (i.e., Class I wells) involve pumping concentrate into a relatively deep saline aquifer (typically 1,000 to 10,000 feet below the ground surface) hydraulically separated from a shallower potable water aquifer. The concentrate must also be compatible with the aquifer materials and in-situ water and not have adverse impacts on underground drinking water supply. In California, an underground source of drinking water is classified as any underground aquifer containing water with TDS less than 10,000 mg/L.

According to the California Department of Water Resources (DWR) Bulletin 118 California's Groundwater, the depth to the base of water bearing sediments in the Santa Clara Groundwater Basin ranges from around 400 to 1,000 feet [see Plate 4 of Bulletin 118]. The deepest well in the Santa Clara Groundwater Basin is near the center of the Basin at 17th and Santa Clara Streets, and is installed to a depth of 1,535 feet. A series of yellow and blue clay intervals with virtually no gravel was logged below 1,000 ft. This indicates water bearing zones may be limited to the intervals above 1,000 feet, and below 1,000 feet there is insufficient permeability to inject concentrate via a well. The zone above 1,000 feet is already utilized for water supply via municipal production wells, and is unsuitable for concentrate injection due to the risk of water quality degradation. Due to local aquifer characteristics and the ongoing use of groundwater as a significant portion of area water supply, deep well injection within the water producing depth of the Santa Clara Groundwater Basin would be unacceptable to regulators and SCVWD. Well injection would only be feasible in very deep zones isolated from overlying water producing aquifers.

Challenges for a deep well injection option include extensive geologic investigations that would be required along with identification of potential oil, gas and water wells in the area; extensive groundwater modeling required; permitting; and, fault lines that may limit aquifer isolation integrity within the region. In California, the USEPA regulates Class I, III, IV, and V wells. A Class I or deep injection well would require the following characteristics and attributes:

- Injected concentrate must have equal to or greater than 10,000 mg/L TDS concentration. If the TDS in the injection zone is less than 10,000 mg/L then the concentrate TDS has to be less than the in-situ aquifer TDS to avoid degrading the aquifer quality. Note that the TDS of the deeper aquifers (i.e., 300 to 1,000 feet below ground surface) in the Santa Clara Groundwater Basin is typically 300 to 400 parts per million (ppm).
- Be located in an area that is free of faults or other adverse geologic features. The injected concentrate must not impact potential underground source of drinking water and must be confined from any formation that potentially could be an underground source of drinking water.
- Testing for integrity of the well at the time of completion and every 5 years thereafter.
- Continuous monitoring to assure well integrity.

Since the project area is not in a zone free of faults, and no deep permeable zones have been identified to date, this option would not be feasible. If this option was feasible, then the costs associated with drilling a Class I injection well could be several million dollars depending on the depth and capacity of the well. After the deep injection well is constructed, the operating costs would likely be relatively small and typically consist of monitoring the well for leaks and periodically cleaning the well screens. For a deep injection well in the Santa Clara Groundwater Basin, highest costs would be related to demonstrate formation permeability and hydraulic separation from the shallower drinking water supply aquifer. Retrofitting abandoned wells are not an option in Santa Clara County because they are too shallow for a Class I well and there would be no hydraulic separation from the water supply aquifer.

Table 6D-30 lists the advantages and disadvantages of this disposal option.

Table 6D-30: Advantages and Disadvantages of Deep Well Injection (Disposal Option 10)

Advantages	Disadvantages
• Several Class I wells approved in California. • Treatment/minimization of concentrate not required prior to disposal. • Small footprint requirement. • Minimal aesthetic impacts. • Could potentially use abandoned exploratory oil and gas wells to eliminate drilling costs.	• Project area is not in a zone free of faults. • Deep permeable zones have not been identified to date. • Limited to deep zones hydraulically separated from the drinking water aquifer. • Significant costs associated with exploratory work to demonstrate permeability at depth and separation from overlying aquifers. • Water quality of discharge water must be better than water in the aquifer if aquifer TDS is less than 10,000 mg/L.

6D.2.11 Zero Liquid Discharge (ZLD) (Disposal Option 11)

ZLD consists of both concentrate minimization and thermal evaporation processes. Concentrate from the primary RO treatment trains is typically run through a treatment train consisting of lime softening or ion exchange, secondary membrane filtration, and secondary RO. The concentrate from the secondary RO is then sent to a brine concentrator followed by a brine crystallizer. Concentrators and crystallizers are paired together to remove solids from the highly concentrated stream.

Brine concentrators are used to convert highly saturated industrial wastewaters into distilled water and very concentrated brine which could be sent to an evaporation pond or a crystallizer. A brine concentrator is similar to a mechanical evaporator, except that the vapor released from the boiling solution is compressed using a compressor. Compression raises the pressure and saturation temperature of vapor so that it may be returned to the evaporator body to be used as heating steam. The latent heat of the vapor is used to evaporate more water instead of being rejected to cooling water. Recovered water from the brine concentrator typically has a TDS concentration of less than 10 mg/L. The stream from the concentrator ranges between 2 to 10 percent of feed water with TDS concentrations as high as 250,000 mg/L. The largest brine concentrators can treat approximately 700 gpm of concentrate. However, most are smaller with capacities around 30 gpm. If needed, brine concentrators can be placed in parallel process lines to treat larger amounts of concentrate. Brine concentrators may also serve to minimize waste when used in conjunction with a disposal method.

Brine concentrators are typically constructed of expensive corrosion resistant materials, such as titanium evaporator tubes and super duplex stainless steel or high molybdenum alloy vessels. Brine concentrators are complicated systems, but are not dependent on weather or geographical conditions. They are expensive to build and operate, and annual maintenance includes one or two chemical cleanings of the evaporator tubes. However, a limiting factor would be the power costs to operate the concentrators – energy consumption can range from 60 to 100 kilowatt-hours (kWh) per 1,000 gallons of feed water.

Table 6D-31 lists the advantages and disadvantages of this disposal option.

Table 6D-31: Advantages and Disadvantages of Brine Concentrators (Disposal Option 11)

Advantages	Disadvantages
• Concentration of concentrate to slurry that can be sent to an evaporation pond or crystallizer. • Climate independent.	☐ High capital and operating costs.

Crystallizers have been used for many years to concentrate feed streams in industrial processes. Crystallizers are mechanical equipment designed to make solid crystals out of concentrated solutions using heat and pressure. More recently, this technology has been studied as a method to reduce concentrate from desalination processes to a transportable solid. Crystallizers are especially applicable in areas where evaporation ponds and deep well injection are not feasible. The capacity of most crystallizers ranges from 2 to 50 gpm. Routine maintenance is typically done to clean/purge the crystallizer body and discharge port/piping.

In all applications a mixture of salts in the concentrate stream will reduce the efficiency and ability of a crystallizer to produce solids. In Arizona, power plants with ZLD systems have installed brine concentrators, crystallizers, and centrifuges to eliminate evaporation ponds for cooling tower blow-down. Municipal wastewater that is fed into these ZLD systems has caused problems due to soluble nitrates and organic fines. In addition, the distillate contains TOC and ammonia, reducing the reuse potential of solids.

Conceptual capital cost estimate for ZLD systems typically run approximately $60M per mgd of flow. Considering a range of concentrate flow between 2.0 mgd and 5.8 mgd, ZLD system costs can range between $120M and $350M.

Table 6D-32 lists the advantages and disadvantages of this disposal option.

Table 6D-32: Advantages and Disadvantages of Crystallizers (Disposal Option 11)

Advantages	Disadvantages
• Concentrates brine into dry residue. • Climate independent.	□ High capital and O&M costs. □ Mechanically complex. • Reduced efficiency when there is a mixture of salts in the concentrate stream to be crystallized. • Additional disposal of crystallized salts to landfill is required.

6D.2.12 Emerging Technologies (Disposal Option 12)

There are emerging concentrate disposal technologies that could be considered for concentrate management as they are developed further. An example is the zero discharge desalination (ZDD) process by Veolia for brackish groundwater systems that uses electrodialysis metathesis to keep potential precipitants separated by charge until concentrated to a point where they are then mixed for effective precipitation, settled and disposed of as a solid. The remaining water is then sent back to the facility feed stream. The recycled water biological and nutrient constituents would be expected to add additional challenge to this technology.

Table 6D-33 lists the advantages and disadvantages of this minimization option.

Table 6D-33: Advantages and Disadvantages of Emerging Technologies (Disposal Option 12)

Advantages	Disadvantages
• High water recovery. • Product water can potentially be marketable.	• Unproven in municipal applications. • Works best in water saturated with calcium sulfate. • Considerable chemical and O&M costs. • Proprietary and patented process

6D.3 Minimization Options

The following concentrate minimization options are discussed in this section:

- Inter-stage lime softening (Minimization Option 1)
- High recovery RO (Minimization Option 2)
- Ion exchange enhancing technologies (Minimization Option 3)
- Emerging technologies (Minimization Option 4)

For certain concentrate disposal options, such as evaporation ponds, it may be cost-efficient to consider additional treatment to minimize the volume of concentrate to be disposed of to reduce the size and cost of the disposal option. Minimization options would need to be used in conjunction with a disposal option. This section provides an overview and a summary of the advantages and disadvantages for each minimization option identified in Table 6D-1.

6D.3.1 Inter-Stage Lime Softening (Minimization Option 1)

One minimization option is the concept of intermediate chemical softening with secondary membrane treatment. This process uses established technologies such as lime softening to increase the recovery of a secondary membrane system, resulting in a higher overall RO recovery. The lime softening treats the reject stream from a primary RO unit prior to treatment through a secondary RO unit. Softening removes chemicals with high scaling potentials such as calcium, magnesium, sulfate, and silica. Lime softening is potentially more cost-effective than mechanical concentration.

Table 6D-34 lists the advantages and disadvantages of this minimization option.

Table 6D-34: Advantages and Disadvantages of Inter-Stage Lime Softening (Minimization Option 1)

Advantages	Disadvantages
• Proven strategy, many installations. • Removal of hardness and operation at high pH (increased silica solubility) allows for high recovery operation of the RO system. • More cost-effective than mechanical concentration. • No additional permitting needed for this application.	□ Large site footprint. □ High chemical usage due to level of hardness and alkalinity in concentrate. □ Harder water means higher sludge production to be dried and disposed offsite. □ Lime handling is labor intensive. □ Requires support facilities (chemical feed, dewatering, sludge drying beds, etc.) • High sludge management costs. • Additional sludge disposal required.

6D.3.2 High Recovery RO (Minimization Option 2)

High recovery RO (HRRO) increases the overall recovery of RO from the typical recovery of 85 percent for reclaimed water applications to approximately 92 percent. The challenge of HRRO is the maintenance of solubility of the remaining constituents within the feed stream. Some previous pilot work has been successfully completed at the Leo J. Vander Lans Water Treatment Facility (LVLWTF) in Long Beach, California for the Water Replenishment District (WRD) to recover secondary effluent in RO to 92 percent with a secondary RO system. The construction of a full-scale HRRO system is currently under way and will be on-line in 2014.

HRRO is designed with added robustness and standby equipment to accommodate the expected higher maintenance frequency. For example, the LVLWTF facility is designed with a redundant secondary RO system to allow one to be in service while one is being cleaned. Such a process drives the solubility to maximum limits, which presents some planning risk if the process is implemented without pilot demonstration with the actual feed water. The high recovery RO system would also be designed with an automatic clean-in-place system to reduce the operator time required for the more frequent clean-in-place (CIP).

Table 6D-35 lists the advantages and disadvantages of this minimization option.

Table 6D-35: Advantages and Disadvantages of High Recovery RO (Minimization Option 2)

Advantages	Disadvantages
• Increased water recovery. • Reduces amount of concentrate to be sent to disposal options and subsequently reducing potential fees.	□ Increased energy consumption. □ Requires additional maintenance costs associated with membrane cleaning and scaling control.

6D.3.3 Ion Exchange Enhancing Technologies (Minimization Option 3)

Several technologies make use of ion exchange media prior to HRRO. These include Aquatech's RO High Efficiency RO (HERO^{TM}) (cationic and anionic), Kruger's OPUS (ballasted flocculation and ion exchange), and CDM Smith's patented High Silica Process (strong acid and weak acid cationic ion exchange RO pre-treatment process). Each system enhances the HRRO process by addressing particular ions of concern that could cause fouling. However, ion exchange systems are typically recharged with brine solutions equal to 1-3 percent of the feed flow that have to be included in the concentrate management strategy.

Table 6D-36 lists the advantages and disadvantages of this minimization option.

Table 6D-36: Advantages and Disadvantages of Ion Exchange Enhancing Technologies (Minimization Option 3)

Advantages	Disadvantages
• Uses combination of proven technologies: ion exchange and RO. • History of industrial installations for concentration of concentrate solutions high in silica. • Recovers water for beneficial use	☐ High capital and O&M costs.

6D.3.4 Emerging Technologies (Minimization Option 4)

As with disposal options, there are emerging minimization technologies that could be considered as the technologies are proven through pilot testing and other installations. An example is Desalitech, which is a relatively new technology which was originally conceived to recover the energy lost by the discharge of RO concentrate in seawater desalination. In Desalitech's treatment concept, much of the concentrate flow is recirculated, allowing for recoveries as high as 97 percent with largely conventional RO equipment on low TDS waters. These conditions are similar to what would be expected for this project. Combined with the claimed 35 percent of energy savings, this concept offers some potential to optimize the brine production and to reduce costs. However, the Desalitech technology has only a few years of development with limited application on the scale or water types of this project.

Table 6D-37 lists the advantages and disadvantages of this minimization option.

Table 6D-37: Advantages and Disadvantages of Emerging Technologies (Minimization Option 4)

Advantages	Disadvantages
• High water recovery. • Simple process for added water recovery.	☐ Unproven in municipal applications. ☐ Requires pilot and demonstration studies. • Proprietary and patented process

6D.4 Summary of Concentrate Management Options

Table 6D-38 provides a summary of the disposal options discussed in the previous sections. At this stage of the project, disposal options that have prohibitive or fatal flaws (due to extremely high costs, complex permitting requirements, or technical infeasibility) are eliminated from further consideration. For options without fatal flaws, conceptual cost estimate and regulatory/permitting complexity for the respective option are rated as low, medium, or high. The following brine managements are assumed as the potentially feasible disposal options for the potable reuse alternatives developed in Section 7:

- Disposal Option 2b, return to SJ/SC RWF via sewer system, for the Ford Pond satellite AWPF
- Disposal Option 6, new outfall to Coyote Point, for the long-term potable reuse alternatives

Additional brine management studies will need to be conducted as part of the programmatic implementation for the long-term potable reuse projects. This additional study is noted in the implementation plan in Section 10.

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Table 6D-38: Summary of Disposal and Minimization Options

Disposal Option	Disposal Method	Local/Regional Management	Conceptual Capital Cost [1]	Regulatory/Permitting Complexity	Preliminary Screening
1	SJ/SC RWF existing outfall	Local	Low	Low	This disposal option could be considered a potentially feasible disposal option for future alternatives evaluations pending successful resolution of brine toxicity concerns. For this Report, due to institutional concerns this option will not be used in the implementation analysis.
2a	Return to SJ/SC RWF for treatment	Local	Low [2]	Low	This disposal option could be considered a potentially feasible disposal option for future alternatives evaluations if the impact of the additional brine on the WRF can be shown to be negligible. For this Report, due to institutional concerns to recycle brine to the RWF, this option will not be used in the implementation analysis.
2b	Return to SJ/SC RWF via sewer system	Local	Low	Low	This disposal option is carried forward in this Report as a potentially feasible disposal option for Ford Pond satellite alternatives development only.
3	Existing regional deep water outfalls (SVCW or EBDA)	Regional	High	High	This disposal option could be considered a potentially feasible disposal option for future alternatives evaluation. For this Report, due to the high cost of construction and other permitting and institutional issues, this option will not be used in the implementation analysis.
4	Existing regional shallow water outfall (Sunnyvale)	Regional	Medium	Medium	Infeasible as a complete concentrate management option, but feasible as a partial concentrate management option.
5	New outfall north of Dumbarton Bridge	Local	High	High	Infeasible – this option had been researched previously by SCVWD and was determined to be infeasible due to high construction costs.
6	New outfall to Coyote Point	Local	Medium	Medium	This disposal option could be considered as a potentially feasible disposal option for future alternatives evaluation. This option is assumed for the basis of potable reuse alternatives costs in this Report.
7	Evaporation pond	Local	N/A	N/A	Infeasible – lack of groundwater separation to meet minimum DDW criteria.
8	Engineered wetlands	Local	High	High	This disposal option is not carried forward as a potentially feasible treatment option for alternatives development in this Report but could be considered in future alternatives analyses when combined with disposal options that could benefit from receiving treated effluent from engineered wetlands.
9	Existing salt ponds	Regional	N/A	N/A	Infeasible – periodic salt pond intake restrictions and concentrate salt concentration is much lower than the typical salt pond feed water.
10	Deep well injection	Local	N/A	N/A	Technically infeasible – the project area is not in a zone free of faults and no deep permeable zones have been identified.

Disposal Option	Disposal Method	Local/Regional Management	Conceptual Capital Cost [1]	Regulatory/Permitting Complexity	Preliminary Screening
11	ZLD	Local	Very High	Medium	Infeasible – very high cost, O&M complexity, and processes are not proven at high capacities.
12	Emerging technologies	Local	N/A	N/A	Technically infeasible – considerable chemical and O&M costs and lack of municipal applications.

Notes:

1 – High level planning capital costs are rated LOW (<$10M), MEDIUM ($10M - $50M), and HIGH (>$50M).

2 – The City has indicated that it would only support a centralized pathway for this disposal option with a pilot demonstration project to demonstrate potential impacts to final effluent.

Attachment A
NPDES Permit Compliance Assessment TM

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South Bay Water Recycling
Strategic and Master Planning

Technical Memorandum

Title: **Brine Discharge Impacts on Compliance with NPDES Permit Effluent Limits**
Version: **Administrative Draft**
Prepared by: **Monica Oakley and Jennie Pang, RMC**
Reviewed by: **Mary Cousins and Marilyn Bailey, RMC**
Date: **October 4, 2013**
Reference: **Task 2.2.5, NPDES Permit Compliance Assessment**

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List of Terms and Abbreviations

AMEL	Average Monthly Effluent Limitation
AWPF	Advanced Water Purification Facility
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin, December 2011
BOD_5	5-Day Biochemical Oxygen Demand
$CBOD_5$	5-Day Carbonaceous Biochemical Oxygen Demand
City	City of San José Environmental Services Department
CTR	California Toxics Rule
Dioxin-TEQ	Dioxin and Furan Toxic Equivalents
IWC	Instream Waste Concentration
MDEL	Maximum Daily Effluent Limitation
MEC	Maximum Effluent Concentration
MF	Microfiltration
NPDES	National Pollutant Discharge Elimination System
PCBs	Polychlorinated biphenyls
RO	Reverse Osmosis
RP	Reasonable Potential
RWF	San José-Santa Clara Regional Wastewater Facility
Regional Water Board	San Francisco Bay Regional Water Quality Control Board
SCVWD	Santa Clara Valley Water District
State Implementation Policy (SIP)	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, 2005
SVAWPC	Silicon Valley Advanced Water Purification Center
TIE/TRE	Toxicity Identification Evaluation/Toxicity Reduction Evaluation
TM	Technical Memorandum
TSD	USEPA Technical Support Document for Water Quality-Based Toxics Control, 1991
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
WQBEL	Water Quality-Based Effluent Limitation
WQC	Water Quality Criteria (federally derived values)
WQO	Water Quality Objective (state-derived value)

Executive Summary

The City of San José Environmental Services Department (City), in partnership with the Santa Clara Valley Water District (SCVWD), is preparing Strategic and Master Planning documents for the South Bay Water Recycling (SBWR) system. Under Task 2.2.5 of this project, National Pollutant Discharge Elimination System (NPDES) Permit compliance for chemical constituents was evaluated for increasing levels of brine discharge conveyed from the reverse osmosis (RO) units to the San José-Santa Clara Regional Wastewater Facility’s (RWF's) outfall to Mallard (Artesian) Slough. Whole effluent toxicity impacts are addressed conceptually in this technical memorandum. However, when the Silicon Valley Advanced Water Purification Center (SVAWPC) starts operation in early 2014, the City will be initiating a chronic toxicity bench-scale testing program to estimate toxicity impacts from various percentages of brine in RWF effluent. In addition, the City is investigating the ability to obtain an Instream Waste Concentration (IWC), i.e. a dilution credit for toxicity, as part of its NPDES Permit renewal during 2014. With an IWC, a proposed new toxicity numeric effluent limit would be more favorable and possibly remove compliance concerns related to brine impacts.

For the analysis of chemical constituents, a mass balance model was developed to estimate final effluent concentrations for conventional, non-conventional, and toxic constituents using brine percentages in final effluent ranging from 0% to 15%. Two types of compliance issues were analyzed to determine brine impacts on NPDES permit compliance, namely (1) exceeding an existing effluent limitation, and (2) triggering a new effluent limit in the future.

It is expected that the RWF will not have significant NPDES Permit compliance issues for final effluent mixed with 15% brine, if City staff closely monitor final effluent concentrations for ammonia and cyanide. A summary of results for increasing brine percentages that trigger a potential NPDES permit compliance issue, under conservative conditions, is shown in **Table ES-1**.

Table ES-1. Summary of Compliance Issues Triggered in the Assessment

Type of Compliance Issue Triggered	Percentage of Brine in Final Effluent	Description of NPDES Permit Compliance Issue [1]
None	0%	---
Effluent Limit – Cyanide	6%	The 95th percentile final effluent concentration for **cyanide** is estimated to exceed the AMEL of 5.7 µg/L. However, the 95th percentile concentration value is influenced by two high measurements in a data set of 67 data points. In addition, based on data availability, the model used final effluent data *after* disinfection as an input to the RO process, and it is not unusual for the disinfection process to create cyanide. If actual secondary effluent data were available for use in the analysis, the final estimated cyanide concentration would likely be lower than that predicted with the model.
Effluent Limit – Total Ammonia	13%	The 95th percentile final effluent concentration for total **ammonia** is estimated to exceed the Average Monthly Effluent Limitation (AMEL) of 3 mg/L. However, the 95th percentile concentration value is influenced by four high values in a data set of 56 data points. If those three high values are not included in the data set, the percentage of brine that can be present in the final effluent is greater than 15%
Effluent Limit – 5-Day Biochemical Oxygen Demand (BOD_5)	15%	The 95th percentile final effluent concentration for **BOD_5** is estimated to exceed the AMEL of 10 mg/L.

[1] Once a compliance issue is triggered, it continues to be an issue for larger brine percentage values. For example, a compliance issue triggered at 6% brine will continue to be an issue at 13% and 15% brine.

As the brine percentage in the final effluent increases, it is recommended that RWF staff continue their current standard practice of sampling early in the month for ammonia and cyanide. If an elevated value is observed, it would be prudent to conduct additional sampling to verify the data point. Additionally, with more frequent sampling, the monthly average values are expected to comply with the AMELs for cyanide and ammonia.

1. Introduction

1.1 Purpose

This Technical Memorandum (TM) has been prepared in accordance with Service Order No. 2, Task 2.2.5 of the SBWR Strategic and Master Planning Project (Strategic Plan) scope of services. The TM evaluates National Pollutant Discharge Elimination System (NPDES) Permit compliance for chemical constituents as a result of increasing levels of brine discharge conveyed from reverse osmosis (RO) units to the San José-Santa Clara Regional Wastewater Facility's (RWF's) outfall.

1.2 Background

Under Task 2.2.5 of this project, NPDES Permit compliance for chemical constituents was evaluated for a range of brine discharge percentages conveyed from the RO units to the RWF's outfall to Mallard (Artesian) Slough. In particular, the analysis was designed to determine whether combining RO brine with RWF effluent would result in (1) an exceedance of NPDES permit effluent limits, and/or (2) new water quality-based effluent limits (WQBELs) based on increased constituent concentrations in the effluent.

Whole effluent toxicity impacts are addressed conceptually in this TM. However, when the Silicon Valley Advanced Water Purification Center (SVAWPC) starts operation in early 2014, the City of San José Environmental Services Department (City) will be initiating a chronic toxicity bench-scale testing program to estimate toxicity impacts from various percentages of brine in RWF effluent. The procedures for the bench-scale testing program are described in the document titled *Chronic Toxicity Compliance Demonstration Plan for Silicon Valley Advanced Water Purification Center (SVAWPC)* prepared by the Santa Clara Valley Water District in January 2013. In addition, the City is investigating the ability to obtain an Instream Waste Concentration (IWC), i.e. a dilution credit for toxicity, as part of its NPDES Permit renewal during 2014. With an IWC, a proposed new toxicity numeric effluent limit would be more favorable and possibly remove compliance concerns related to brine impacts.

A 2008 study titled, "South Bay Advanced Recycled Water Treatment Facility – Impact of RO Concentration Stream on WPCP Effluent Quality" previously evaluated the impacts of reverse osmosis (RO) brine on final effluent quality, exploring a range of possible project sizes up to an RO permeate of 32 million gallons per day (MGD), with a combination of 1 part tertiary effluent to 1.8 parts RO permeate. The analysis considered conventional and toxic pollutants by using a simplified mass balance model.

This TM takes the information in the 2008 study further by evaluating compliance impacts with updated water quality data, as well as updated numeric effluent limits from the RWF's 2009 NPDES Permit. The assessment described in this TM is also more precise in that the mass balance model developed for this project considers the advanced treatment processes of microfiltration and reverse osmosis as two separate treatment systems (instead of as a single treatment system), and uses the percentage of brine in final effluent as input, rather than estimated flow rates in MGD. This approach makes the information more scalable in the event the RWF effluent flows change over time. In addition, this assessment is more precise in that advanced treatment rejection rates were used for specific pollutants based on experience, and secondary effluent data were used for total suspended solids (TSS). This assessment also explores two important future regulatory issues: a potential nutrient watershed permit with nutrient limits and an anticipated statewide toxicity plan.

1.3 Related Work

Related work under Service Order No. 2 of the SBWR Strategic and Master Planning project includes:

- Subtask 2.3.2 and 2.3.3 Indirect Potable Reuse Market Assessment and Local Brine Management

2. Existing and Future Effluent Limits

2.1 Existing Effluent Limitations

The RWF currently discharges treated wastewater to Mallard (Artesian) Slough under NPDES Permit No. CA0037842, which was adopted as San Francisco Bay Regional Water Quality Control Board (Regional Water Board) Order No. R2-2009-0038. The Regional Water Board amended this permit with new regional standard provisions and monitoring and reporting requirements (Order No. R2-2010-0054). In addition, mercury and polychlorinated biphenyls (PCBs) are regulated under NPDES Permit No. CA003849 (Order No. R2-2012-0096).

The NPDES permit contains numeric effluent limits for conventional, non-conventional, and toxic constituents. Effluent limits for conventional and non-conventional constituents, also known as technology-based effluent limits, were determined based on regional, state, and federal requirements. Effluent limits for toxic constituents, also known as water quality-based effluent limits (WQBELs), were developed based on requirements in the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan), the California Toxics Rule (CTR), and the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Plan, or SIP).

The RWF is classified as a shallow water discharger because its discharge does not receive a minimum initial dilution of 10:1. In order to discharge under an exception to the shallow water discharge prohibition in the Basin Plan, the RWF provides advanced wastewater treatment, operates a recycled water program, conducts environmental enhancement activities, and has certain effluent limits that are more stringent than secondary treatment standards. Numeric effluent limits indicated in the RWF's existing NPDES permits are shown in **Table 1**.

Table 1: San José-Santa Clara RWF Effluent Limits[1]

	Constituent	Units	Effluent Limitations				
			Average Monthly Effluent Limitation (AMEL)	Average Weekly Effluent Limitation (AWEL)	Maximum Daily Effluent Limitation (MDEL)	Instantaneous Minimum	Instantaneous Maximum
Conventional and Non-Conventional Constituents	5-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	10	---	20	---	---
	Total Suspended Solids (TSS)	mg/L	10	---	20	---	---
	Oil and Grease	mg/L	5	---	10	---	---
	pH	standard units	---	---	---	6.5	8.5
	Total Chlorine Residual	mg/L	---	---	---	---	0.0
	Turbidity	NTU	---	---	---	---	10
	Total Ammonia	mg-N/L	3	---	9	---	---
Toxic Constituents	Copper	µg/L	11	---	19	---	---
	Mercury[2]	µg/L	0.025	0.027	---	---	---
	Nickel	µg/L	25	---	33	---	---
	Cyanide	µg/L	5.7	---	14	---	---
	Dioxin-TEQ	µg/L	1.4×10^{-8}	---	2.8×10^{-8}	---	---
	Heptachlor	µg/L	0.00021	---	0.00042	---	---
	PCBs (as arochlors)	µg/L	0.00039	---	0.00049		
	Tributyltin	µg/L	0.0064	---	0.012	---	---

[1] See NPDES permits (Order Nos. R2-2009-0038 and Order No. R2-2012-0096) for detailed footnotes to effluent limits.

[2] The RWF also has an average annual mass effluent limit for mercury. Compliance with this limit is determined annually by first evaluating the sum of the mass for all municipal wastewater facilities discharging under the mercury and PCBs watershed permit. If this sum is greater than the group mass limit of 11 kg/yr, each municipal discharger whose individual mercury mass emission limit exceeds its individual allocation in the watershed permit shall be deemed to be in violation of its mercury mass limit. For reference, the group mass emission in 2011 was 2.9 kg/yr.

2.2 Potential Future Effluent Limitations

Prior to each NPDES permit renewal [1], toxic constituent concentrations measured in an agency's effluent during the previous permit term are evaluated. Constituents with concentrations that have "reasonable potential" (RP) to cause or contribute to an exceedance of a water quality criterion or objective in the receiving water (Mallard (Artesian) Slough or San Francisco Bay) are given a numeric effluent limit in the new permit. Maximum effluent concentrations (MECs) are used to determine whether RP is present for each toxic constituent.

Three triggers are used for determining RP as described in the SIP:

1. The first trigger (Trigger 1) is activated if the MEC is greater than or equal to the lowest applicable water quality criteria (WQC) or water quality objective (WQO)[2], which has been adjusted, if appropriate, for pH, hardness, and translator data. If the MEC is greater than or equal to the adjusted WQO, then that constituent has RP, and a WQBEL is required.

2. The second trigger (Trigger 2) is activated if the observed maximum ambient background concentration is greater than the adjusted WQO, and the constituent is detected in any of the effluent samples.

3. The third trigger (Trigger 3) is activated if a review of other information determines that a WQBEL is required to protect beneficial uses, even though both the MEC and the maximum ambient background concentration for a particular constituent are less than the WQO.

In the future, new or more stringent effluent limits which may be adopted in NPDES permits include nutrients and toxicity. Numerous scientific studies are being conducted to understand the impact of nutrients in San Francisco Bay. Presently, the Regional Water Board is developing a nutrients watershed permit which may include new effluent limits for nutrients. Compliance with possible future nutrient limits is discussed and explored in this TM.

In addition, the California State Water Resources Control Board is currently preparing a statewide toxicity plan. Draft versions of this document have proposed a new standardized method of data analysis (called the Test of Significant Toxicity, or TST), new numeric limits for chronic toxicity, and new provisions for compliance determination. This TM provides a detailed summary of the steps being taken to quantify potential toxicity impacts from the addition of brine to final effluent.

3. Constituents Identified for Compliance Assessment

Of the many chemical constituents measured by the RWF (more than a hundred), only a few are of interest for compliance assessment. Constituents were included in the compliance assessment if there is at least one effluent limit for that compound. For constituents without effluent limits, the constituent was included in the compliance assessment if it was detected in the effluent between June 1, 2009 and August 31, 2013. If a constituent was detected in the effluent, but there are currently no water quality criteria or objectives (e.g. beryllium, chloroform, and benzo(ghi)perylene), that constituent was removed from the list. Also, oil and grease was not considered because it would not be present in the RO concentrate since it would cause fouling in the RO membranes. Additionally, chlorine residual was not included since disinfection is expected to occur downstream of where the brine would be combined with RWF effluent, and pH was not included because pH is not concentrated in the RO process. The resulting list of constituents identified for compliance assessment is shown in **Table 2**.

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[1] NPDES Permit renewals occur approximately once every five years.

[2] WQC is the federal term and WQO is the state term. These terms are synonymous and WQO is used to represent both terms in the rest of this TM.

Table 2: Constituents Identified for NPDES Permit Compliance Assessment

	Constituent	Unit	Primary Reason for Assessing Compliance
Conventional and Non-Conventional Constituents	5-Day Biochemical Oxygen Demand (BOD_5) (1)	mg/L	Effluent Limit
	Total Suspended Solids (TSS)	mg/L	Effluent Limit
	Turbidity	mg/L	Effluent Limit
	Total Ammonia	mg-N/L	Effluent Limit
Toxic Constituents	Metals and Cyanide:		
	Antimony	µg/L	Detected Value
	Arsenic	µg/L	Detected Value
	Cadmium	µg/L	Detected Value
	Chromium, Total	µg/L	Detected Value
	Copper	µg/L	Effluent Limit
	Lead	µg/L	Detected Value
	Mercury	µg/L	Effluent Limit
	Nickel	µg/L	Effluent Limit
	Selenium	µg/L	Detected Value
	Silver	µg/L	Detected Value
	Thallium	µg/L	Detected Value
	Zinc	µg/L	Detected Value
	Cyanide	µg/L	Effluent Limit
	Organic Constituents:		
	Bromoform	µg/L	Detected Value
	Chlorodibromomethane	µg/L	Detected Value
	Dichlorobromomethane	µg/L	Detected Value
	1,3-Dichloropropylene	µg/L	Detected Value
	Methylene Chloride	µg/L	Detected Value
	Toluene	µg/L	Detected Value
	Bis(2-Ethylhexyl)Phthalate	µg/L	Detected Value
	Dibenzo(a,h)Anthracene	µg/L	Detected Value
	Indeno(1,2,3-cd)Pyrene	µg/L	Detected Value

[1] The RWF monitors BOD_5 to comply with its effluent limits for $CBOD_5$.

4. Impact Assessment Approach (Mass Balance Model)

The impact assessment approach employed a mass balance model to estimate constituent concentrations in final effluent containing various brine percentages. The model was designed to be conservative, and the basis for model development is described in this section.

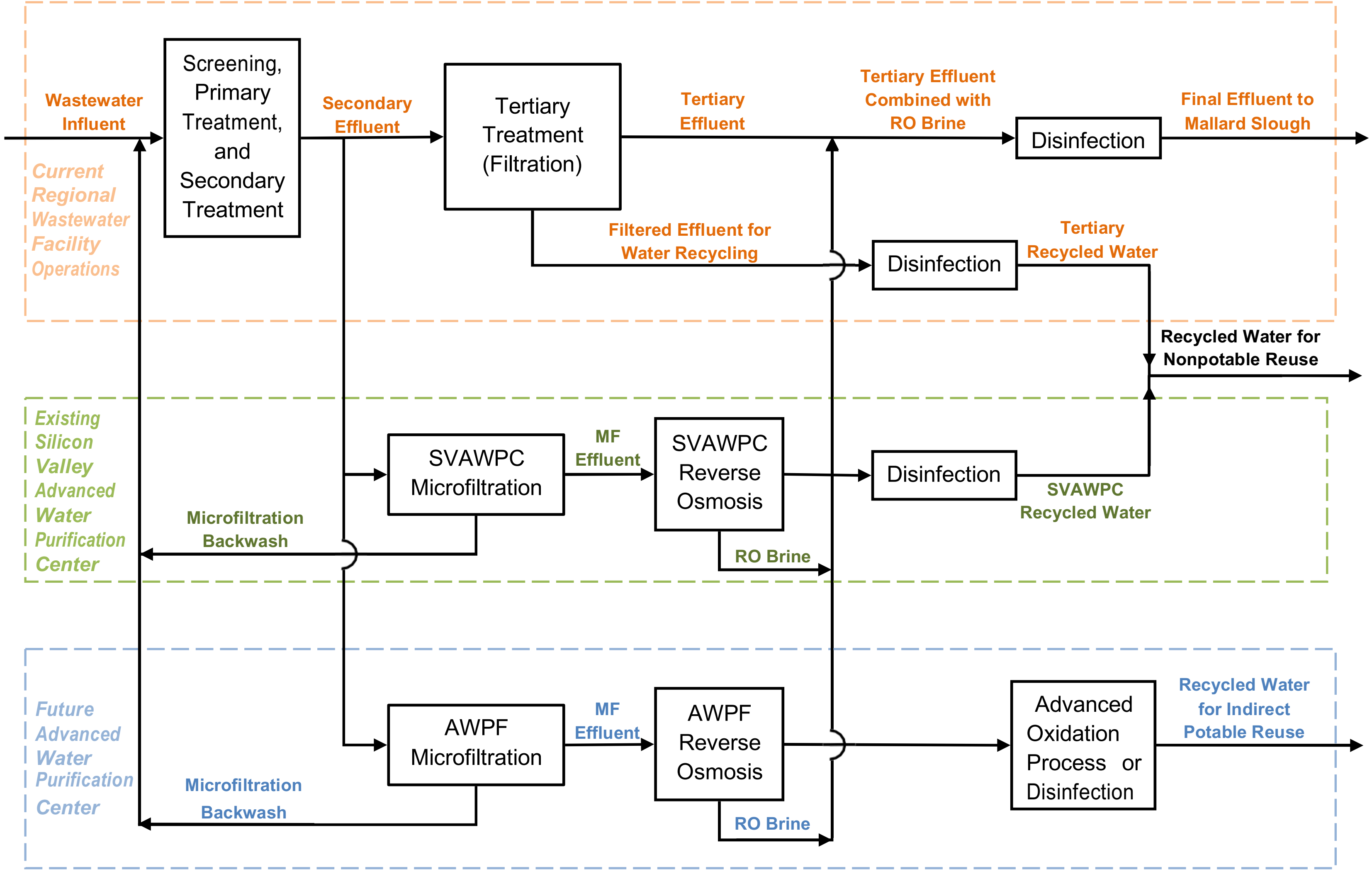
4.1 Advanced Treatment Process Configuration

The mass balance model incorporates recycled water production processes that will occur at both the existing Silicon Valley Advanced Water Purification Center (SVAWPC) and a potential new Advanced Water Purification Facility (AWPF) that would be one of the options for Indirect Potable Reuse (IPR).

The AWPF is expected to run in parallel with the SVAWPC. Both the SVAWPC and the proposed AWPF would treat secondary effluent by microfiltration (MF) and RO. Cleaning the microfilters produces a backwash, which is conveyed to the RWF's headworks, and the RO systems produce brine to be combined with tertiary effluent, which is then disinfected for discharge to Mallard (Artesian) Slough. Note that it is assumed that the RO brine would not be introduced into the chlorine contact channel that is used for Title 22 recycled water production. The processes related to the impact of brine on final effluent water quality are shown in the process flow diagram in **Figure 1**.

Although conveyance of brine to the RWF headworks has been contemplated, in the event toxicity impacts are observed with the brine, this configuration was not modeled because it is not the preferred operating method.

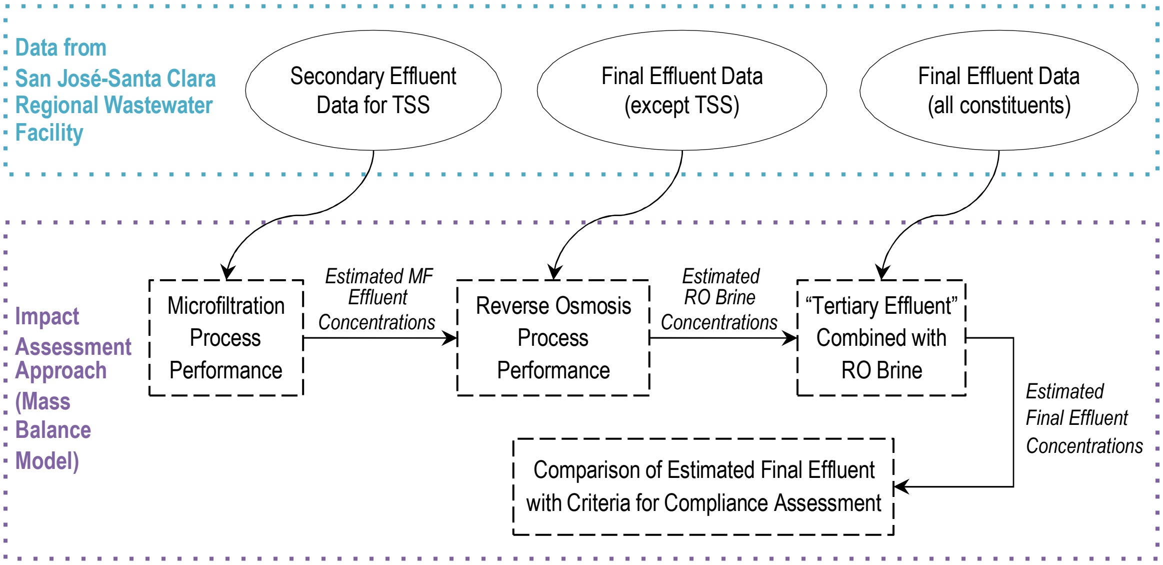
Figure 1. Process Flow Diagram of Proposed Recycled Water Facilities to Assess Brine Impacts on NPDES Permit Compliance


Wastewater Influent
Current Regional Wastewater Facility Operations
Screening, Primary Treatment, and Secondary Treatment
Secondary Effluent
Tertiary Treatment (Filtration)
Tertiary Effluent
Tertiary Effluent Combined with RO Brine
Disinfection
Final Effluent to Mallard Slough
Filtered Effluent for Water Recycling
Disinfection
Tertiary Recycled Water
Recycled Water for Nonpotable Reuse
Existing Silicon Valley Advanced Water Purification Center
SVAWPC Microfiltration
MF Effluent
SVAWPC Reverse Osmosis
Disinfection
SVAWPC Recycled Water
Microfiltration Backwash
RO Brine
Future Advanced Water Purification Center
AWPF Microfiltration
MF Effluent
AWPF Reverse Osmosis
Advanced Oxidation Process or Disinfection
Recycled Water for Indirect Potable Reuse
Microfiltration Backwash
RO Brine

4.2 Conceptual Framework for Mass Balance Model

Using the process flow diagram for the proposed recycled water facilities shown in **Figure 1** above, a conceptual framework was developed for the mass balance model. The existing SVAWPC facility and the future AWPF facility were grouped together within the model. Secondary effluent data for TSS (only) were available for this analysis and therefore those data were used as input to the MF process prior to reverse osmosis (RO). For constituents other than TSS, secondary effluent data were not available; therefore, final effluent data for these constituents were used as a surrogate for MF effluent being conveyed to RO. This approach is conservative, since the MF process is expected to provide better treatment than the RWF's filtration processes for these constituents. The estimated RO brine concentrations were then combined with tertiary effluent data before comparing to the criteria for compliance assessment. The data used as input to the model, as well as the computations performed within the model itself, are shown diagrammatically in **Figure 2**.

Figure 2. Conceptual Diagram of Mass Balance Model


Data from San José-Santa Clara Regional Wastewater Facility
Secondary Effluent Data for TSS
Final Effluent Data (except TSS)
Final Effluent Data (all constituents)
Impact Assessment Approach (Mass Balance Model)
Microfiltration Process Performance
Estimated MF Effluent Concentrations
Reverse Osmosis Process Performance
Estimated RO Brine Concentrations
"Tertiary Effluent" Combined with RO Brine
Estimated Final Effluent Concentrations
Comparison of Estimated Final Effluent with Criteria for Compliance Assessment

The conditions simulated in the model, some of which are conservative, are summarized as follows:

- Existing effluent limits will be similar numerically to future effluent limits – Future effluent limits over the planning horizon were assumed to be similar to existing limits. There is currently little basis to expect otherwise at the present time, except possibly for nutrients, for which there is significant uncertainty at the present time. In any event, if control of nutrient concentrations or mass is needed in the future, this activity would most likely be addressed within the RWF rather than in an advanced water purification center.
- The variability of secondary (TSS) and final effluent (other constituent) concentrations will be similar over the planning horizon – Since reduced data for the existing RWF performance are used as inputs to the model, it is being assumed that future variability in these concentrations

during the planning horizon would not be much different than this variability. The sensitivity of changes to data variability is described in subsequent sections of this TM.

- Existing WQOs will be similar numerically to future WQOs - Future WQOs over the planning horizon were assumed to be the same as existing applicable WQOs.
- Existing maximum constituent data are compared to WQOs for compliance assessment – The existing maximum values for constituents without existing effluent limits that have been detected in the effluent were used in the model. Therefore it is being assumed that future maximum concentrations during the planning horizon would not be any higher than these maxima.
- Final effluent contains similar concentrations of priority pollutants as secondary treatment after treatment with MF – This assumption is probably the most conservative aspect of the model. Data for TSS is currently collected immediately following secondary treatment at the RWF, but priority pollutant samples are not collected because this location is not a regulatory compliance point. Although there was no correlation between TSS and heavy metals (and possibly other priority pollutants) in the final effluent, it's likely there is some relationship between the amount of TSS removed across the filters and the amount of heavy metals removed across the filters. For reference, on average, there is currently about 84% removal of TSS between secondary effluent and final effluent, whereas the percent removal between secondary effluent and the end of the MF process was estimated in the model to be 99.99% for TSS. This approach means that the results estimated in this analysis will be conservative. In particular, the results are based on the feed to RO being tertiary (final) effluent instead of MF effluent. Therefore, a higher mass of constituents is both entering RO and exiting in the RO brine in the model than would actually occur.
- Final effluent contains similar concentrations as tertiary effluent prior to disinfection – It is unlikely the constituent concentrations, except cyanide, will noticeably change across the disinfection process. However, it is not unusual for cyanide measured in the final effluent to be created in the disinfection process, so cyanide concentration results are likely to be more conservative than other constituents under this condition.
- MF and RO removal percentages are based on experience with other facilities – It is possible the actual advanced water purification center will experience somewhat different removal percentages, especially over time as the facilities age. With aging facilities, the percent removal across MF or RO would decrease and therefore the brine concentrations would decrease, so the removal percentages used in this analysis are expected to be conservative.

4.3 Criteria for Compliance Assessment

For constituents with effluent limits, the 95th and 99th percentile concentration values on a lognormal basis were generally compared to the Average Monthly Effluent Limitation (AMEL) and the Maximum Daily Effluent Limitation (MDEL), respectively. (To be conservative, the 99th percentile concentration value was also compared to the Average Weekly Effluent Limitation (AWEL) for mercury.) For turbidity, the maximum effluent concentration (MEC) value was compared to the instantaneous maximum effluent limit. This approach is consistent with the method commonly used by Regional Water Board staff to assess whether compliance with effluent limits is feasible for a wastewater treatment plant.

In addition to effluent limits, this assessment was designed to determine whether the selected priority pollutants without effluent limits would trigger reasonable potential (RP) when RO brine is combined with tertiary effluent. RP by Trigger 1 was also assessed for un-ionized ammonia because, although un-ionized ammonia is not a priority pollutant listed in the CTR, the Basin Plan contains water quality objectives for this constituent to protect against the aquatic life effects of ammonia in receiving waters. RP by Trigger 1 was determined based on the applicable WQOs shown in **Table 3**.

Table 3: Governing WQOs for Detected Constituents without WQBELs[1]

Constituent	Unit	Lowest Applicable Water Quality Criterion or Water Quality Objective
Antimony	µg/L	4,300
Arsenic	µg/L	36
Cadmium	µg/L	7.3
Chromium (III)	µg/L	644
Chromium (VI)	µg/L	180
Lead	µg/L	135
Selenium	µg/L	5
Silver	µg/L	2.2
Thallium	µg/L	6.3
Zinc	µg/L	170
Bromoform	µg/L	360
Chlorodibromomethane	µg/L	34
Dichlorobromomethane	µg/L	46
1,3-Dichloropropylene	µg/L	1,700
Methylene Chloride	µg/L	1,600
Toluene	µg/L	200,000
Bis(2-Ethylhexyl)Phthalate	µg/L	5.9
Dibenzo(a,h)Anthracene	µg/L	0.049
Indeno(1,2,3-cd)Pyrene	µg/L	0.049
Un-ionized Ammonia	mg-N/L	0.025

[1] The ammonia effluent limit in the existing RWF NPDES Permit is technology-based, not water quality-based.

Five constituents could potentially trigger RP by Trigger 2 because the maximum ambient background concentration is greater than the WQO. These constituents are benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, 4,4-DDE, dieldrin, and heptachlor epoxide. However, out of these five, only indeno(1,2,3-cd)pyrene was detected in recent RWF effluent samples, therefore RP by Trigger 2 is assessed for only this constituent.

Existing constituents with effluent limits by Trigger 3 for the RWF include copper, nickel, and dioxin-TEQ, which have estimated WBQELs shown in **Table 1**. RP by Trigger 3 for other constituents was not investigated in this assessment because no other constituents are currently anticipated to be triggered with discretion in the Bay Area for the foreseeable future.

4.4 Advanced Water Treatment Feed Quality

TSS data for secondary effluent collected from January 1, 2007 through August 31, 2013 were used in this analysis. For the remaining constituents identified for NPDES Permit compliance assessment, final effluent concentration data collected from June 1, 2009 through August 31, 2013 were used. These data are shown in **Appendix A**. More specifically, the reduced data used in the mass balance model based on the information presented above are shown in **Table 4**. Although average values for constituents with existing effluent limits were not used in the assessment, they are provided in **Table 4** for reference.

Table 4: RWF Data Used as Inputs to Mass Balance Model

	Constituent	Type of Concentration Data Used in Model[1,2]	Unit	Number of Detected Values	Concentrations			
					Average (for reference)	95th Percentile	99th Percentile	MEC
Conventional and Non-Conventional	5-Day Biochemical Oxygen Demand (BOD$_5$)	Tertiary Effluent [2]	mg/L	639	3.2	5.4	6.9	
	Total Suspended Solids (TSS)	Secondary Effluent	mg/L	2447	7.9	12.4	15.3	
		Tertiary Effluent [2]	mg/L	677	1.5	2.5	3.3	
	Turbidity	Tertiary Effluent	NTU	1551	1.3			4.0
	Total Ammonia	Tertiary Effluent	mg-N/L	56	0.8	1.7	2.7	2.6
Detected Toxic Priority Constituents	Metals and Cyanide:							
	Antimony	Tertiary Effluent	µg/L	97				0.58
	Arsenic		µg/L	122				1.78
	Cadmium		µg/L	121				0.15
	Chromium, Total		µg/L	122				1.1
	Copper		µg/L	122	3.1	4.6	5.5	
	Lead		µg/L	122				2.62
	Mercury		µg/L	51	0.0016	0.0027	0.0035	
	Nickel		µg/L	123	6.3	8.0	8.8	
	Selenium		µg/L	58				0.67
	Silver		µg/L	122				0.11
	Thallium		µg/L	94				0.39
	Zinc		µg/L	122				34.2
	Cyanide		µg/L	37	2.1	4.3	6.1	
	Organic Constituents:							
	Bromoform	Tertiary Effluent	µg/L	1				DNQ 0.004
	Chlorodibromomethane		µg/L	6				13.9
	Chloroform		µg/L	8				34.9
	Dichlorobromomethane		µg/L	7				20.2
	1,3-Dichloropropylene		µg/L	1				DNQ 0.52
	Methylene Chloride		µg/L	5				DNQ 0.47
	Toluene		µg/L	6				0.9
	Bis (2-Ethylhexyl) Phthalate		µg/L	1				DNQ 1.6
	Dibenzo(a,h)Anthracene		µg/L	1				DNQ 0.011
	Indeno(1,2,3-cd) Pyrene		µg/L	1				DNQ 0.009

[1] The model uses data for secondary effluent sampled from January 1, 2007 through June 11, 2013 and tertiary effluent sampled from June 2009 through August 2013.

[2] "Tertiary effluent" signifies data that are sampled at the RWF discharge point to Mallard (Artesian) Slough after disinfection (final effluent).

4.5 Advanced Water Treatment Process Performance

Treatment process performance parameters were used in this analysis, namely *recovery rates* and *rejection rates*, which are described as follows:

- **Recovery rates** represent the percentage of process feed water that receives treatment on a flow basis. For example, if 100 MGD of secondary treated wastewater is fed to an MF process with a 98% recovery rate, 98 MGD exits the process as treated MF effluent and 2 MGD exits the process as concentrated backwash. In the mass balance model, a 98% recovery rate is used for the MF process and an 85% recovery rate is used for the RO process. These values are based on the design specifications for the SVAWPC and consultant experience with similar advanced treatment systems.

- **Rejection rates** represent the percentage of constituent that is rejected by an advanced treatment process on a mass basis. For example, in the case of process feed water with a mass flow rate of 100 g/day of Constituent *X*, and a rejection rate for Constituent *X* of 95%, the reject flow from this process would contain 95 g/day of Constituent *X*.

The rejection rates used in the model are based on various vendor software data as well as experience with similar advanced treatment systems, and are shown in **Table 5**. The smallest values in the rejection rate ranges for MF and the largest values in the rejection rate ranges for RO (underlined values in **Table 4**) were used in the model, to be conservative.

Table 5: Range of Rejection Rates for MF and RO Processes

	Constituent	Estimated Rejection Rate [1]	
		MF	MF-RO Combined System
Conventional and Non-Conventional Constituents	5-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	0-30%	>99%
	Total Suspended Solids (TSS)	>99.99%	>99.99%
	Turbidity	>99.99%	>99.99%
	Total Ammonia	0%	25-98%
Detected Toxic Priority Constituents	*Metals:*		
	Antimony	0%	97-99%
	Arsenic (III)		70-80%
	Arsenic (V)		98%
	Cadmium		96-98%
	Chromium (III)		97-99%
	Chromium (VI)		97-99%
	Copper		97-99%
	Lead		97-99%
	Mercury		96-98%
	Nickel		96-98%
	Selenium		96-98%
	Silver		96-98%
	Thallium		96-98%
	Zinc		93-96%
	Cyanide	0%	93-96%
	Organics:		
	Bromoform	0%	>99%
	Chlorodibromomethane		
	Dichlorobromomethane		
	1,3-Dichloropropylene		
	Methylene Chloride		
	Toluene		
	Bis(2-Ethylhexyl)Phthalate		
	Dibenzo(a,h)Anthracene		
	Indeno(1,2,3-cd) Pyrene		

[1] The underlined rejection rates were used in the mass balance model.

4.6 Range of Brine Percentages Modeled

The maximum, potential recycled water production being evaluated under this Strategic and Master Planning project is 50,000 AFY, or 45 MGD of recycled water. This amount of recycled water would result in 8 MGD of brine. In addition, to obtain 45 MGD of recycled water, 54 MGD of secondary effluent from the RWF would be required (on a roughly annual average basis), with flow recovery rates of 98% and 85% for the MF and RO systems, respectively. Further, if 54 MGD (on average) of RWF secondary effluent is conveyed to a purification facility, that leaves 46 MGD to be combined with the brine. The combination of 46 MGD final effluent with 8 MGD brine is 54 MGD, with a brine percentage of 15%.

On this basis, when considering the planning horizon for SBWR projects, the estimated percentage of brine in the final effluent could potentially approach 15%. Therefore, a range of 0% to 15% for the percentage of brine in final effluent was used in developing a detailed estimate of the potential impacts on NPDES Permit compliance.

5. Results and Discussion

The results of the mass balance model indicate possible but controllable compliance issues with total ammonia and cyanide, as described in the sections below.

5.1 No Compliance Issues Predicted at 0% Brine

With no brine in the effluent, the model predicts the RWF will not have compliance issues with existing effluent limits for chemical constituents. This result is consistent with current compliance at the RWF.

5.2 Potential Compliance Issue for Cyanide Triggered at 6% Brine

With 6% brine in the final effluent, the estimated final effluent concentration for cyanide using the mass balance model is more than 5.8 µg/L, which is based on an input to the model of the 95th percentile of the RWF existing final effluent data (4.3 µg/L). On this basis, the estimated final effluent concentration at 5.8% brine would exceed the AMEL of 5.7 µg/L. However, the 95th percentile concentration of actual RWF data is likely influenced by two particularly high values in the data set. In addition, 59 of the 67 data points analyzed are below the laboratory quantitation limit. Recent cyanide effluent data are shown with existing NPDES permit effluent limits in **Figure 4**.

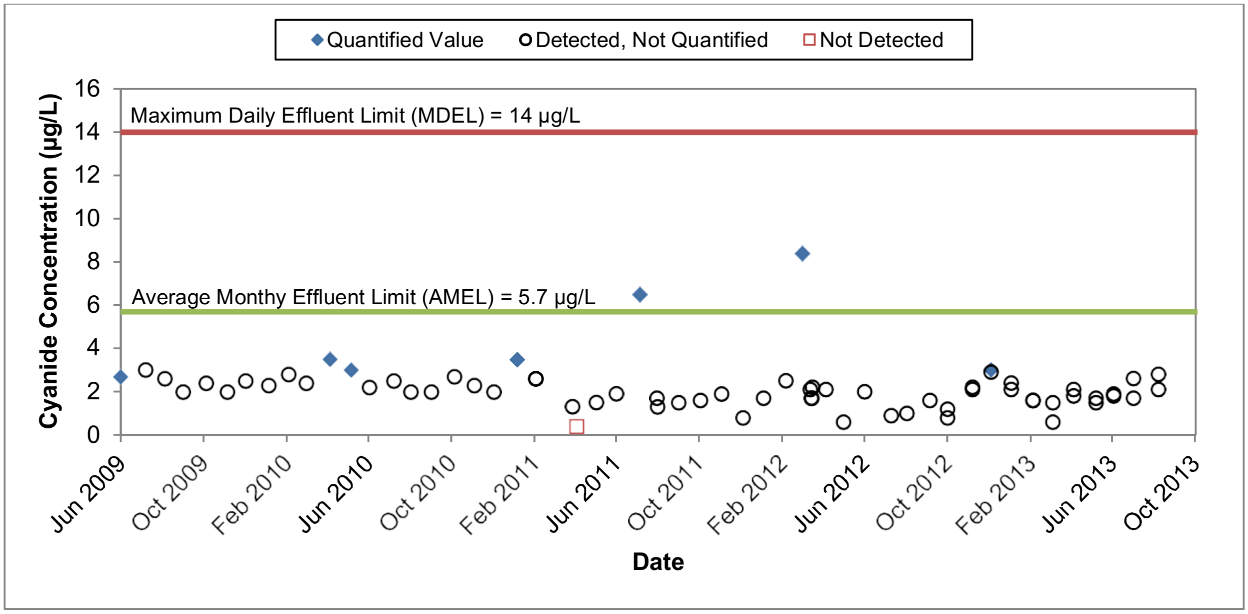


Figure 3. Final RWF Effluent Data for Cyanide (Jun 2009-Aug 2013)

To test the sensitivity of the model to the high values in the data, the model was used to estimate a final effluent concentration based on an input comprising the 83rd percentile concentration value (3.1 µg/L) of existing data, to reduce the influence of the high values on the model's results. There are no compliance issues when the 83rd percentile value is used for both input to the model and output for comparison to the AMEL. As a check, the median value was also simulated in the model, and in this case there were no compliance issues either. A summary of the sensitivity analysis is shown in **Error! Reference source notfound.**.

Table 6. Model-Input and Model-Estimated Final Effluent Concentrations for Cyanide (µg/L)

Percentile Value	[Model Input] Final Effluent Concentration, Jun 2009-Sep 2013	[Model Estimate] Final Effluent Concentration with 15% Brine in Final Effluent	Predicted Compliance Issue?
Median	2.0	3.7	None
83rd percentile	3.1	5.6	None
95th percentile	4.3	7.9	Exceeds AMEL of 5.7 µg/L

RWF staff currently collect samples for cyanide once per month to comply with the AMEL. Because the AMEL is an *average monthly* effluent limit and the sample frequency is monthly, the limit would be exceeded if just one data point is greater than 5.7 µg/L. However, RWF staff typically sample cyanide early in the month, so if a result is observed higher than expected, staff has the flexibility to take additional samples to confirm whether there is a persistent issue with cyanide. In addition, if subsequent results indicate the first result was unusually high, it is probable that the monthly average will be less than 5.7 µg/L. The past effluent data shown in **Figure 4** indicate that RWF staff have employed this approach for the two high values observed in July 2011 and March 2013 to confirm that there were no issues with cyanide in RWF effluent.

Additionally, the estimated final effluent concentrations for cyanide may be conservative for other reasons. As reported in the RWF's 2012 Annual Industrial User Pretreatment Compliance Report, cyanide concentrations in the RWF's influent have remained relatively constant at or below the quantitation limit. Effluent concentrations are sometimes higher than the influent concentrations at the RWF, suggesting that cyanide may be produced in the wastewater treatment process. This situation likely occurs because cyanide is a suspected byproduct of chlorination, which is the disinfection process at the RWF. It is possible that the model overestimates cyanide concentrations for the brine because, for cyanide, the model uses historical data for final effluent sampled *after* disinfection as an input to the RO process (instead of MF effluent which would not be influenced by disinfection).

5.3 Potential Compliance Issue for Ammonia Triggered at 13% Brine

With 13% brine in the final effluent, the estimated final effluent concentration for total ammonia using the mass balance model is more than 3.0 mg-N/L, which is based on an input to the model of the 95th percentile of the RWF existing final effluent data (1.7 mg-N/L). On this basis, the estimated final effluent concentration at 13% brine would exceed the AMEL of 3 mg-N/L. However, the 95th percentile concentration of actual RWF data is likely influenced by four particularly high values in the data set. Recent total ammonia effluent data are shown with existing NPDES permit effluent limits in **Figure 3**.

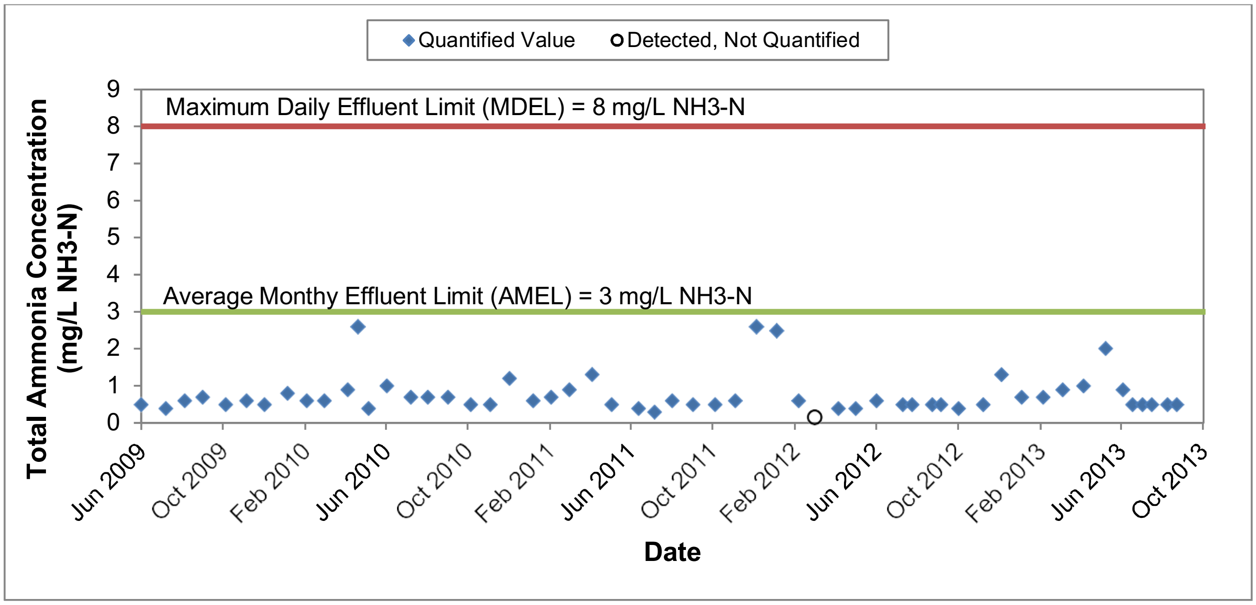


Figure 4. Final RWF Effluent Data for Total Ammonia (Jun 2009-Aug 2013)

To test the sensitivity of the model to the high values in the data, the model was used to estimate a final effluent concentration based on an input comprising the 93rd percentile concentration value (1.6 mg-N/L) of existing data, to reduce the influence of high values on the model's results. There are no compliance issues at 15% brine when the 93rd percentile value is used for both input to the model and output for comparison to the AMEL. As a check, the median value was also simulated in the model, and in this case there were no compliance issues either. A summary of the sensitivity analysis is shown in **Table 7**.

Table 7. Model-Input and Model-Estimated Final Effluent Concentrations for Ammonia (mg-N/L)

Percentile Value	[Model Input] Final Effluent Concentration, Jun 2009 - Aug 2013	[Model Estimate] Final Effluent Concentration with 15% Brine in Final Effluent	Predicted Compliance Issue?
Median	0.6	1.1	None
93rd percentile	1.6	2.9	None
95th percentile	1.7	3.2	Exceeds AMEL of 3 mg/L

As with cyanide, The RWF monitors cyanide monthly, and the AMEL may be exceeded if just one data point is greater than 3 mg-N/L. Likewise, RWF staff typically sample ammonia early in the month, so if a result is observed higher than expected, staff has the flexibility to take additional samples to confirm whether there is a persistent issue with ammonia. In addition, if subsequent results indicate the first result was unusually high, it is probable that the monthly average will be less than 3 mg/L.

5.4 Potential Compliance Issue for BOD_5 Triggered at 15% Brine

With 15% brine in the final effluent, the estimated final effluent concentration for BOD_5 using the mass balance model is 10.1 mg/L, which is based on an input to the model of the 95th percentile of the RWF existing final effluent data (5.4 mg/L). On this basis, the estimated final effluent concentration at 15% brine would exceed the AMEL of 10 mg/L. Recent BOD_5 effluent data, which are taken on a more frequent basis than cyanide and ammonia, are shown with existing NPDES permit effluent limits in **Figure 5**. A discussion with RWF staff indicated that the higher BOD_5 values experienced recently happen from time to time and are not an anomaly.

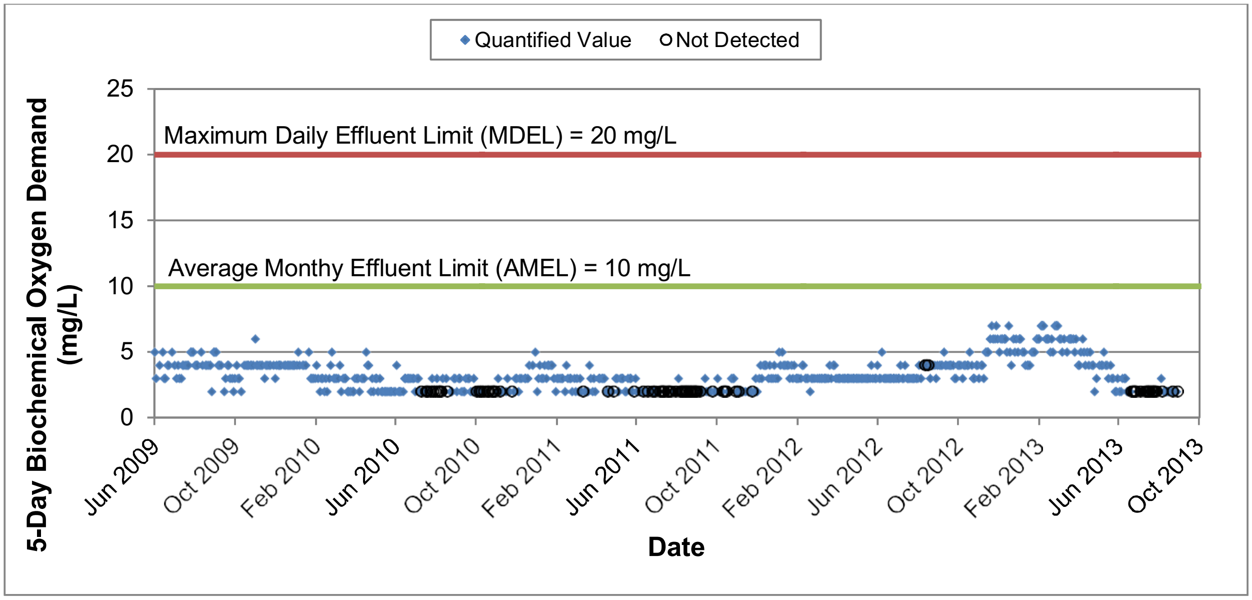


Figure 5. Final RWF Effluent Data for BOD_5 (Jun 2009-Aug 2013)

5.5 Compliance Issues Predicted for Final Effluent with > 15% Brine

A summary of the predicted brine percentages for each of constituents identified for compliance assessment, including those greater than 15%, that may cause exceedances of limits or WQOs (thereby indicating a need for a new effluent limit) is provided in **Table 8**.

Table 8. Brine Percentages Predicted to Trigger Compliance Issues

	Constituent	NPDES Permit Limit or Lowest Applicable WQO	Estimated Percentage of Brine in Final Effluent Predicted to Trigger (1) NPDES Permit Compliance Issue or (2) Need for New Effluent Limit
Conventional and Non-Conventional Constituents	5-Day Biochemical Oxygen Demand (BOD_5) [1]	AMEL = 10 mg/L	15%
		MDEL = 20 mg/L	35%
	Total Suspended Solids (TSS)	AMEL = 10 mg/L	Greater than 100%
		MDEL = 20 mg/L	Greater than 100%
	Turbidity	Instantaneous Maximum = 10 NTU	30%
	Total Ammonia	AMEL = 3 mg/L as N	13%
		MDEL = 8 mg/L as N	40%
Detected Toxic Priority Constituents	Metals and Cyanide		
	Antimony	WQO = 4300 µg/L	Greater than 100%
	Arsenic	WQO = 36 µg/L	Greater than 100%
	Cadmium	WQO = 7.3 µg/L	Greater than 100%
	Chromium, Total	WQO (Cr(III))= 644 µg/L WQO (Cr(VI))= 180 µg/L	Greater than 100%
	Copper	AMEL = 11 µg/L	25%
		MDEL = 19 µg/L	45%
	Lead	WQO = 116 µg/L	Greater than 100%
	Mercury	AMEL = 0.025 µg/L	Greater than 100%
		AWEL = 0.027 µg/L	Greater than 100%
	Nickel	AMEL = 25 µg/L	40%
		MDEL = 33 µg/L	50%
	Selenium	WQO = 5 µg/L	Greater than 100%
	Silver	WQO = 2.2 µg/L	Greater than 100%
	Thallium	WQO = 6.3 µg/L	Greater than 100%
	Zinc	WQO = 170 µg/L	75%
	Cyanide	AMEL = 5.7 µg/L	6%
		MDEL = 14 µg/L	18%
	Organic Constituents:		
	Bromoform	WQO = 360 µg/L	Greater than 100%
	Chlorodibromomethane	WQO = 34 µg/L	30%
	Dichlorobromomethane	WQO = 46 µg/L	25%
	1,3-Dichloropropylene	WQO = 1700 µg/L	Greater than 100%
	Methylene Chloride	WQO = 1600 µg/L	Greater than 100%
	Toluene	WQO = 200,000 µg/L	Greater than 100%
	Bis (2-Ethylhexyl) Phthalate	WQO = 5.9 µg/L	50%
	Dibenzo(a,h)Anthracene	WQO = 0.049 µg/L	65%
	Indeno(1,2,3-cd) Pyrene	WQO = 0.049 µg/L	80%

[1] The effluent limit in NPDES Permit is expressed as 5-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), but the RWF measures BOD_5.

6. Nutrients

The mass balance model was also used to assess how combining brine with tertiary effluent may affect compliance with possible future effluent limits for total nitrogen, organic nitrogen, and total phosphorus. The MF/RO rejection rates for total nitrogen, organic, nitrogen, and total phosphorus were estimated to be 99%, 99%, and 98%, respectively; these rejection rates were estimated based on consultant experience with similar advanced treatment systems.

The following three figures were developed to show the brine percentage (for 0% to 15%) at which compliance is estimated to be feasible for a particular average monthly effluent limit. For these nutrients, the 95th percentile concentration values for final effluent sampled from July 2012 through August 2013, and the recovery rates of 98% for MF and 85% for RO, were used in the model.

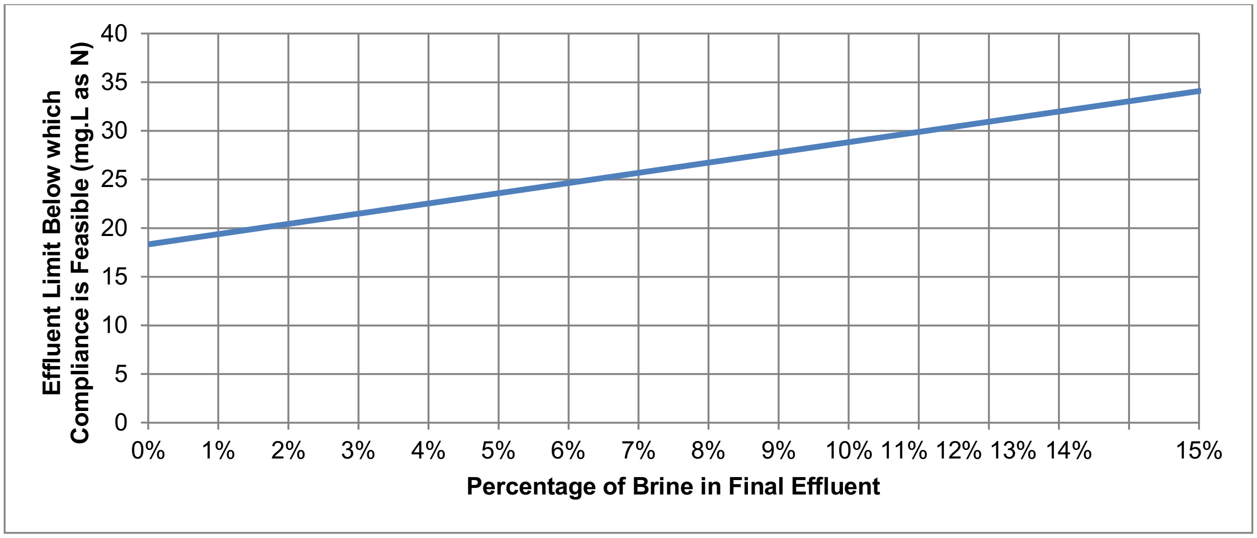


Figure 6. Estimated Effluent Limit Compliance Feasibility - Total Nitrogen

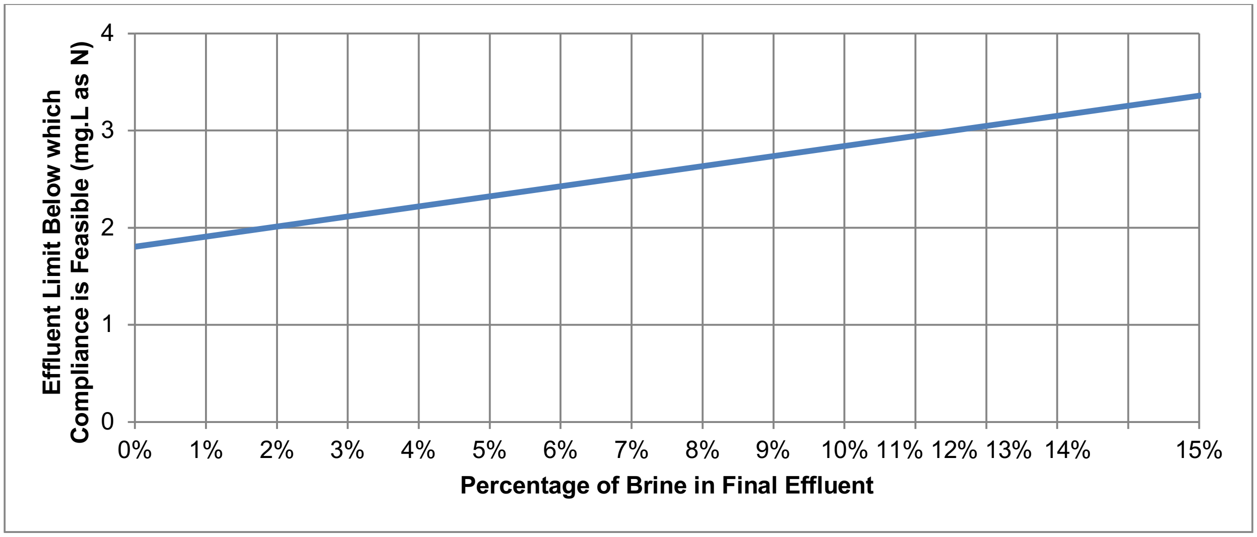


Figure 7. Estimated Effluent Limit Compliance Feasibility - Organic Nitrogen

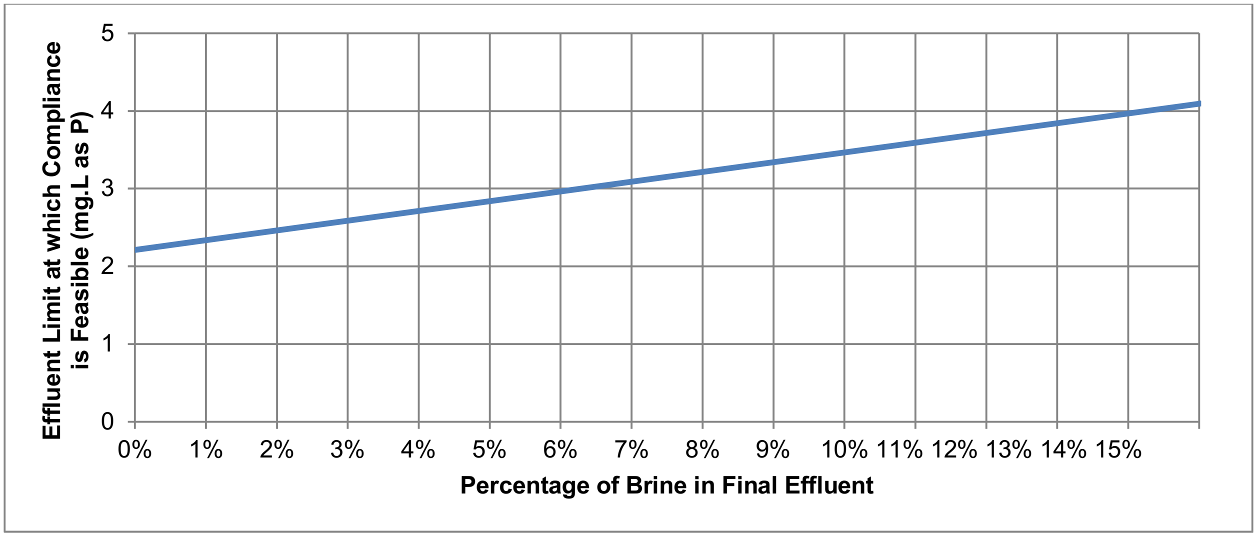


Figure 8. Estimated Effluent Limit Compliance Feasibility - Total Phosphorus

As a greater amount of brine is discharged in the final effluent, final effluent will contain higher concentrations of nutrients. Thus, higher effluent limits will be needed for greater amounts of brine in the final effluent.

7. Toxicity

In early 2013, RWF staff observed chronic toxicity in RWF effluent. In March 2013, chronic toxicity results of RWF effluent triggered accelerated toxicity testing, and chronic toxicity was detected again in April and May. In response, RWF staff initiated a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE).

With production of RO brine in the SBWR system, concerns regarding chronic toxicity that may be present in effluent containing brine must be addressed, particularly with respect to whether the source of toxicity is the brine vs. some other constituent or group of constituents. In 2009-2011, SCVWD conducted bench-scale testing for acute and chronic toxicity of RWF final effluent combined with 2% and 9% of brine that was rejected from an RO process treating RWF secondary effluent. Acute toxicity tests conducted with Rainbow Trout and Inland Silversides fish indicated a lack of acute toxicity for both samples of effluent containing 2% and 9% brine. Chronic toxicity was not observed for tests conducted for Fathead Minnow fish growth and Inland Silversides growth. Other chronic toxicity tests for *Ceriodaphnia dubia* (a water flea) reproduction and *Thalassiosira pseudonana* (a marine diatom) growth showed effects with *Thalassiosira pseudonana* appearing more sensitive to the brine addition than *Ceriodaphnia dubia*. Subsequently, RWF staff conducted additional rounds of bench-scale testing for *Thalassiosira pseudonana* growth to further assess the toxicity of RO brine; results were mixed with only one of the four rounds showing chronic toxicity.

To address concerns raised in earlier chronic toxicity tests, SCVWD and City staff have prepared a Chronic Toxicity Compliance Demonstration Plan to conduct bench-scale tests on actual brine produced at the SVAWPF, and monitor the degree of toxicity that may be present. The chronic toxicity testing will be conducted monthly, and both the City and SCVWD will reevaluate the location of brine injection to the RWF, and modify the chronic toxicity testing plan as necessary based on results observed.

Chronic toxicity is a property of a wastewater effluent and is quantified based on the observed toxic effects on aquatic organisms from the pollutants contained the effluent. A mathematical relationship rarely exists between the "dose" of effluent (a mixture of pollutant concentrations in the effluent), and the measurable effect of the effluent on an organism. Thus, a mass balance model cannot be used to accurately estimate future chronic toxicity values.

Toxicity is also dependent on a mixture of water quality constituents in effluent. As shown in **Table 5,** advanced water treatment processes reject different pollutants at different rates. The mixture of different water quality constituents in the effluent combined with brine may vary significantly depending on the operation of the advanced treatment processes.

Since chronic toxicity can only be estimated with empirical relationships, and the variability in the concentrations of constituents in effluent can change incrementally over time with limited knowledge about the source of the change, this TM does not address whole effluent toxicity impacts. Rather, the bench-scale toxicity testing to be initiated after SVAWPC begins operation will provide the best information for predicting whether toxicity impacts could be present in brine at the percentages of RWF effluent potentially anticipated for the future.

In addition, the City is investigating the ability to obtain an Instream Waste Concentration (IWC), i.e. a dilution credit for toxicity, as part of its NPDES Permit renewal during the next year. A proposed new chronic toxicity numeric effluent limit which incorporates an IWC could possibly remove compliance concerns related to brine impacts.

8. References

1. California Toxics Rule (CTR). May 18, 2000. United States Environmental Protection Agency (USEPA).
2. Chronic Toxicity Compliance Demonstration Plan for Silicon Valley Advanced Water Purification Center (SVAWPC). January 30, 2013. Santa Clara Valley Water District.
3. Chronic Toxicity Testing of Reverse Osmosis Reject Water at Bench Scale. July 1, 2011. Santa Clara Valley Water District.
4. Engineer's Report, South Bay Advanced Recycled Water Treatment Facility. December 2009. Black & Veatch.
5. National Pollutant Discharge Elimination System (NPDES) Permit No. CA0037842 (San José/Santa Clara Water Pollution Control Plant). April 8, 2009. San Francisco Bay Regional Water Quality Control Board.
6. NPDES Permit No. CA0038849 (SF Bay Mercury and PCBs Watershed Permit). December 12, 2012. San Francisco Bay Regional Water Quality Control Board.
7. Order No. R2-2010-0054 (Amendment of Waste Discharge Requirements for Municipal and Industrial Dischargers). February 26, 2010. San Francisco Bay Regional Water Quality Control Board.
8. Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Plan, or SIP). 2005. California State Water Resources Control Board.
9. Technical Support Document for Water Quality-Based Toxics Control (TSD). March 1991, USEPA.
10. Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan). December 31, 2011. San Francisco Bay Regional Water Quality Control Board.

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Attachment B

Chronic Toxicity Testing of RO Reject Water at Bench Scale

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Final Internal Draft

Chronic Toxicity Testing of Reverse Osmosis Reject Water at Bench Scale

Internal Draft Approval

SUPERVISOR APPROVAL	
☒ APPROVED ☐ DISAPPROVED	1 July 2011 DATE
DIVISION MANAGER APPROVAL	
☐ APPROVED ☐ DISAPPROVED	DATE
WPC DEPUTY DIRECTOR APPROVAL	
☐ APPROVED ☐ DISAPPROVED	DATE
ASSISTANT DIRECTOR APPROVAL	
☐ APPROVED ☐ DISAPPROVED	DATE
DIRECTOR APPROVAL	
☐ APPROVED ☐ DISAPPROVED	DATE

San Jose/Santa Clara Water Pollution Control Plant (Plant)-South Bay Water Recycling Program
Advanced Water Treatment (AWT) Project

Chronic Toxicity Testing of Reverse Osmosis Reject Water at Bench Scale

Background.

The Santa Clara Valley Water District, with contract support from Black & Veatch, EOA, Inc. and Pacific EcoRisk Inc., conducted acute and chronic toxicity testing on Plant Final Effluent blended with 2 percent and 9 percent of Reverse Osmosis (RO) Reject Water (Brine) extracted from Secondary Effluent process water at the San Jose/Santa Clara Water Pollution Control Plant between December 2009 and June 2010. Samples of Plant Secondary Effluent were collected and concentrated in a bench scale RO Pilot apparatus. A total of five rounds of testing were completed by the Water District on one or more species as described below and summarized in Table 1 at the end of this document.

Water District Acute Toxicity Testing.

Two rounds of acute toxicity testing (i.e. survival endpoint) were conducted with Rainbow Trout and Inland Silversides fish. After two rounds, acute testing was discontinued due to lack of acute toxicity in the RO Brine.

Water District Chronic Toxicity Testing.

a. Two rounds of chronic toxicity testing were conducted measuring Fathead Minnow fish growth. This testing was also discontinued after two rounds due to lack of chronic toxicity to this species.
b. Three rounds of chronic testing were conducted measuring Inland Silversides growth. This testing was also discontinued due to lack of observed chronic toxicity.
c. Five rounds of chronic toxicity testing were conducted measuring *Ceriodaphnia dubia,* a water flea, for reproduction and *Thalassiosira pseudonana*, a marine diatom, for growth.
    i. During the first two rounds of testing, several tests were disregarded because the test dilution water (Plant Final Effluent) was also toxic. In these cases, it was impossible to determine whether the reject/plant final effluent blend was also toxic since all of the toxicity could have come from the dilution water (Plant Final Effluent) and not the reject/plant final effluent blend.
    ii. Over all five rounds of this chronic toxicity testing, there were three tests in which slight toxicity was observed in the reject/plant final effluent blend but not in the Plant Final Effluent dilution water.
        1. During Round 3, the Ceriodaphnia had reduced reproduction in the 9% reject blend compared to control animals. However, the toxicity was rather low (1.3 chronic Toxic Units) and there was no toxicity in the 2% reject blend. Since the initial phase of the AWT Project is expected to only produce a 1.5% reject blend with Plant Final Effluent, this toxic result was not considered critical.
        2. The toxicity observed in both the 2% and 9% reject blends during Round 4 testing with Thalassiosira was 1.4 TUc and 1.5 TUc, respectively.

Because of the toxicity detected in Round 4, a fifth round of testing was conducted to test only the sensitivity of the Thalassiosira to reject. No toxicity was observed in Round 5.

San Jose Chronic Toxicity Testing.

The San Jose/Santa Clara Water Pollution Control Plant conducted an additional four rounds of testing, using Thalassiosira pseudonana growth, to further assess potential AWT reject toxicity.

a. The first round of San Jose testing indicated reduced growth in both 2% and 9% reject blends compared to control cultures and were therefore toxic (Figure 1.A).
b. The AWT reject produced in Rounds 2 & 3 caused relatively uniform growth stimulation relative to the added reject (Figure 1.B&C). AWT reject can cause growth stimulation because the reject is a source of nutrients as well as a source of potential toxicants.
c. Round 4 also produced non toxic results. However, the growth stimulation measured in the 2% and 9% blends diluted with Plant Final Effluent up to 50% was not observed in the 100% blends (Figure 1.D). Growth in the 100% blends dropped markedly, indicating that toxicity inhibited growth compared to the 50% blends. However, this drop in growth in the Round 4 100% blends was not statistically significant.

Figure 1A. San Jose Test Results - July

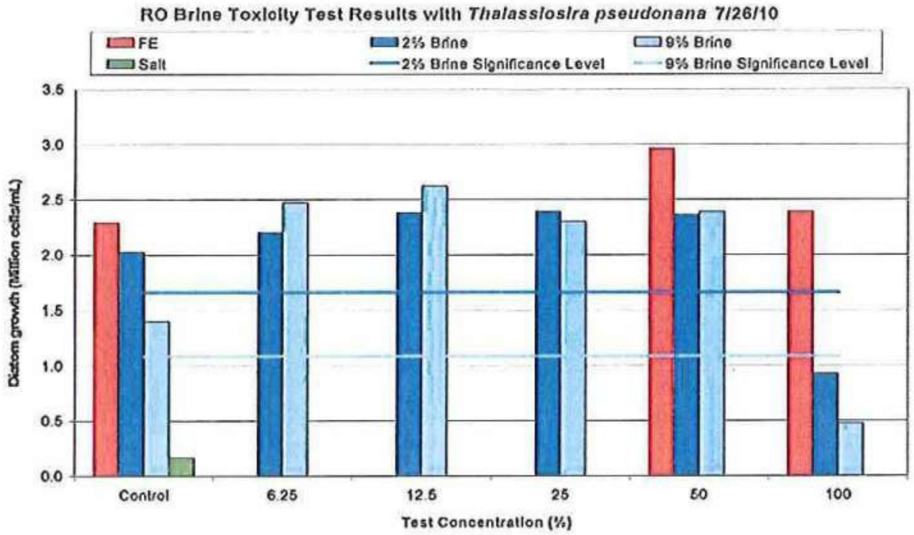


Figure 1B. San Jose Test Results - August

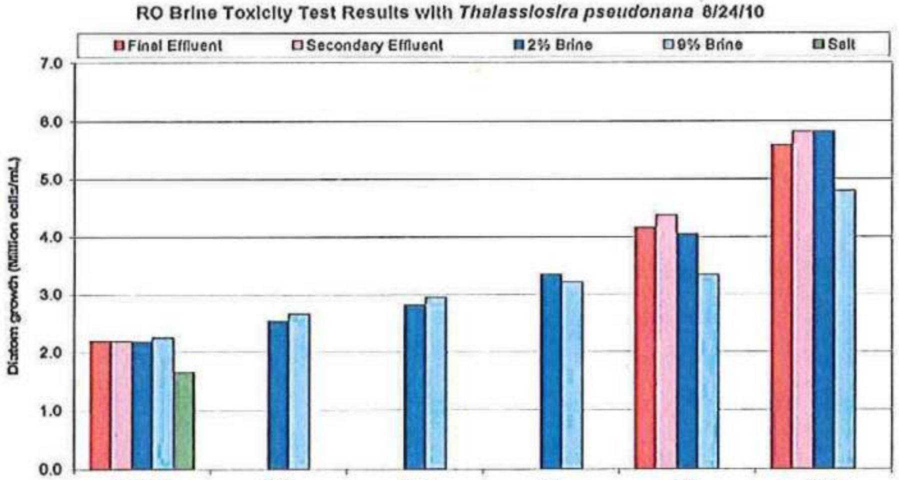


Figure 1C. San Jose Test Results – October

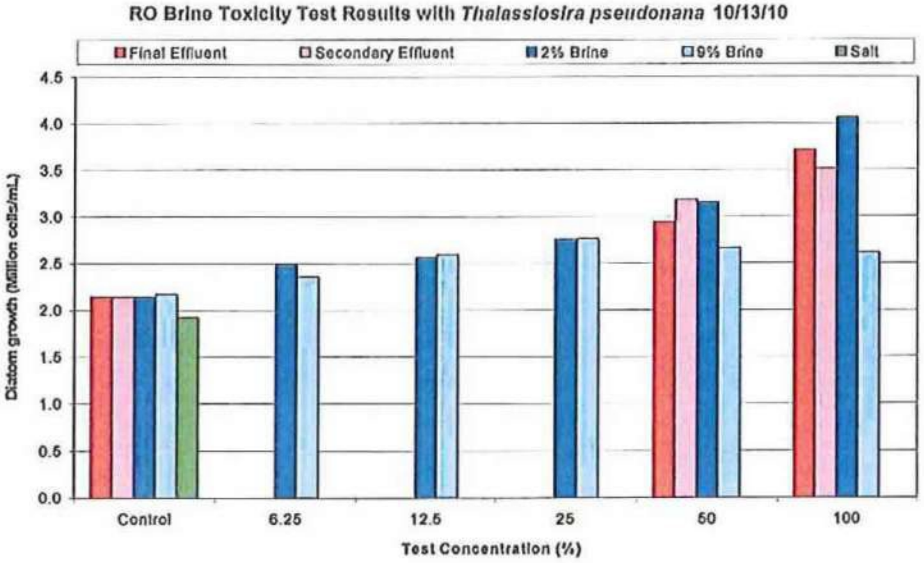
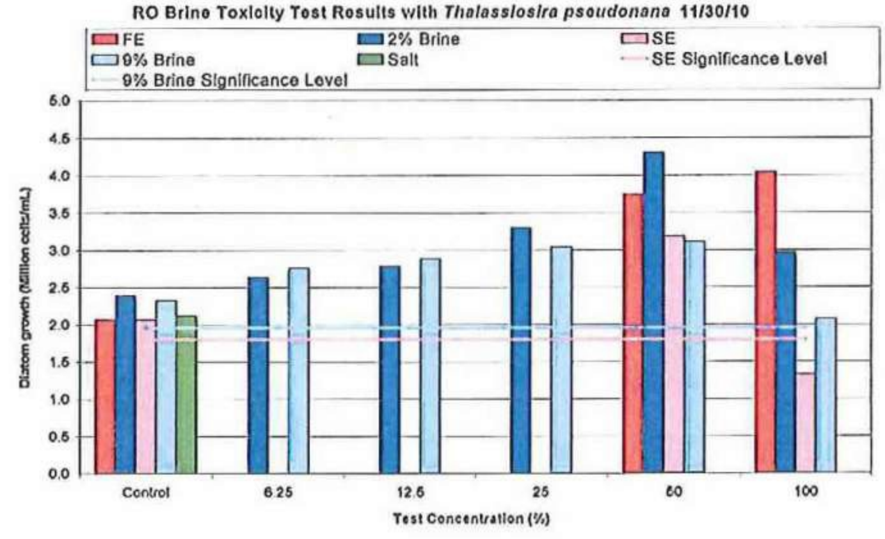


Figure 1D. San Jose Test Results – November



Significance of the AWT Toxicity Results for the Plant:

The test results summarized above raise concerns that the AWT operated at full scale may lead to increased monitoring requirements and could even lead to sporadic incidents of chronic toxicity. These are factors to consider:

1. The sensitivity of the marine diatom, *Thalassiosira pseudonana*, to AWT reject observed during Round 4 of the Water District testing and in Round 1 of the San Jose testing. The Plant's NPDES Permit and the State's Implementation Policy require that, if possible, test species used to characterize plant effluent chronic toxicity prior to each NPDES Permit renewal include a fish, an invertebrate, and a plant (i.e. algae). It is not possible to use the freshwater algal species, *Selenastrum capricornutum*, because selenastrum was found in earlier characterization studies to be sensitive to the salinity of Plant Final Effluent. The only reasonable alternative is Thalassiosira, therefore, Thalassiosira will be evaluated. If this species is found to be more sensitive to Plant final effluent than Ceriodaphnia after addition of AWT reject, then the next NPDES permit for the Plant will likely include a requirement to conduct monthly toxicity testing using Thalassiosira.
2. The Plant's recent history of episodic chronic toxicity using the water flea, *Ceriodaphnia dubia*, that culminated in a Plant's Toxicity Reduction Evaluation (TRE) in 2010 demonstrates that the Plant final effluent is at least occasionally very close to the threshold of unacceptable chronic toxicity using current testing methods.
    - It is unlikely that the constituents in Plant Final Effluent which caused sporadic chronic toxicity to *Ceriodaphnia dubia*, a freshwater invertebrate, are the same constituents that occasionally caused toxicity to the marine diatom, *Thalassiosira pseudonana*. The marine diatom appears to be more sensitive than the water flea to AWT reject. Based on the Water District's Round 3 testing, the marine diatom may also be more sensitive to Plant Final Effluent (without added reject).
    - This raises the possibility, that the Regional Water Board could require the Plant to test two chronic test species if both show significant sensitivity to Plant Final Effluent during the next Effluent Characterization (toxicity screening), conducted approximately one year prior to the next Permit renewal in May 2014.
3. The State's proposed Whole Effluent Toxicity (WET) Policy which proposes to set numerical limits, with associated "violations," for WET exceedances. The State's proposed WET Policy includes a requirement to use a statistical evaluation tool known as the Test of Significant Toxicity or TST. This could increase the Plant's chronic toxicity trigger exceedances or cause violations, particularly if Thalassiosira testing is required in the future.

Discussion of Possible Strategies:

1. **Species sensitivity and recent Plant toxicity:** The above testing suggests that the marine diatom, *Thalassiosira pseudonana*, is more sensitive to AWT reject than the Plant's current WET test species, *Ceriodaphnia dubia*. Thalassiosira is also likely more sensitive to Plant Final Effluent than ceriodaphnia. Most of the Quality Control (QC) failures listed in Table 1 resulted from toxicity in Plant Final Effluent, of which the marine diatom had the greater number of QC failures. However, during the additional four rounds of AWT testing conducted by the Plant, toxicity of Plant Final Effluent to Thalassiosira was not observed.

   It may be possible to petition the Water Board to exclude this species from consideration in the next effluent characterization study prior to the next NPDES Permit renewal. There are a few reasons why such a petition might be accepted.

- Phytoplankton, including marine diatoms may not be viewed by the Water Board as being as ecologically important as freshwater zooplankton, such as *C. dubia*. It may be difficult to argue this point if *C. dubia* does not appear to be as sensitive as *T. pseudonana* in the next effluent characterization study.
- It could be theoretically (or perhaps empirically) argued that the marine diatom is likely more sensitive to the potential ion imbalance in AWT reject.

The worst case scenario for the Plant would be for the Water Board to impose a requirement to routinely test both chronic species. Given the Plant's recent history of toxicity using both species, this could potentially happen if an effluent characterization study further indicated that Plant Final Effluent is toxic to both species. It is not known whether this issue could or should be discussed with the Water Board in conjunction with permitting the AWT.

2. **State's Proposed WET Policy:** The State's proposed WET Policy would replace the Plant's current toxicity triggers with numerical limits. Any exceedance of a numerical limit could be assessed as a violation of the NPDES permit. It is likely that the addition of reject to Plant Final Effluent will at least slightly elevate the risk of future WET violations. The results of Water District and Plant AWT testing alone suggests that the additional risk of toxicity is 33.3% (1 out of 3 tests) for *C. dubia* using a 9% reject blend, and 33.3% (2 out of 6 tests) for *T. pseudonana* using both 2% and 9% reject blends.

3. **Return of Reject to Plant Headworks:** In the event that reject from the AWT facility increases the Plant's incidence of chronic toxicity when blended directly to Plant Final Effluent, an alternative plan should be in place to divert the RO reject water to Plant Headworks. From headworks, the reject would pass through the entire Plant treatment process which would presumably decrease the level of toxicity in the effluent as needed. However, returning reject to the headworks will increase the TDS of the secondary effluent which will impact the TDS of AWT feed water and hence the AWT product water.

4. **Dilution:** This discussion would not be complete without a discussion of a receiving water dilution credit for WET. Nearly all of the chronic toxicity in Plant Final Effluent observed during the recent TRE was above 50% effluent. All of the toxicity observed during the AWT testing conducted by the Water District and the Plant (nine total test results for two species) was above a 50% effluent threshold. This means that a dilution credit equal to the one applied to the Plant for cyanide would virtually solve the Plant's WET issues, present and future. The arguments for a dilution credit of 3 (dilution of 2) include:

   - The need for a dilution credit for chronic toxicity could be demonstrated by the Plant's recent history and the AWT testing.
   - Water column toxicity is not detected in the San Francisco Bay.
   - The Water Board may agree to allowance of a dilution credit as a means of promoting Recycled Water production.
   - The Plant's 1989 Dilution Study measured a Bay water/Plant final effluent dilution of 2:1. This was used to determine the Plant's dilution for cyanide. An updated dilution study would probably have to be performed to advance this argument.

Additional Testing:

Additional testing of RO reject produced by the full scale AWT facility is recommended.

Since measurable toxicity in the Plant's final effluent discharged to the Bay could be assessed as a violation of the NPDES discharge permit, more testing should be performed prior to discharging reject to the serpentine tanks. It is possible that the bench scale AWT toxicity testing performed so far may not be truly representative of full scale AWT reject production. If the full scale RO units produce a final effluent/reject mixture that exhibits no measurable toxicity to Thalassiosira, many of the issues discussed in this paper will be less of a concern. However, if full scale testing yields similar or worse results, the issues discussed here will take on a greater urgency.

TABLE 1. SCVWD ROUNDS 1-5 PILOT TOXICITY TESTING RESULTS

	Round 1 (Dec. 3-9, 2009)			**Round 2 (Feb. 4-10, 2010)**			**Round 3 (Mar. 24-30, 2010)**			**Round 4 (Apr. 26-May 3, 2010)**		
Test Organism	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**
Acute Toxicity (% Survival)												
Rainbow Trout	100	100	100	100	100	100	NA	NA	NA	NA	NA	NA
Menidia	100	100	100	100	100	100	NA	NA	NA	NA	NA	NA
Chronic Toxicity (TUc)												
Menidia												
Survival	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Growth	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA
Fathead Minnow												
Survival	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA
Growth	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA
Ceriodaphnia												
Survival	<1	<1	<1	<1	<1	<1	<1	<1	**1.1**	<1	<1	<1
Growth	**2.8**	**3.0**	<1	<1	<1	<1	<1	<1	**1.3**	<1	<1	<1
Thalassiosira												
Cell Density	**3.1**	**2.7**	**3.4**	**6.2**	**3.4**	**Failed**	<1	<1	<1	<1	**1.38**	**1.46**

NA = Not Available (test not run)
Failed = Test Failed (QA/QC)
Bold = Toxicity Detected

TBD = To Be Determined (results pending analysis)

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TABLE 1. SCVWD ROUNDS 1-5 PILOT TOXICITY TESTING RESULTS (CONT'D)

	Round 5 (Jun. 10, 2010)											
Test Organism	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**									
Acute Toxicity (% Survival)												
Rainbow Trout	NA	NA	NA									
Menidia	NA	NA	NA									
Chronic Toxicity (TUc)												
Menidia												
Survival	NA	NA	NA									
Growth	NA	NA	NA									
Fathead Minnow												
Survival	NA	NA	NA									
Growth	NA	NA	NA									
Ceriodaphnia												
Survival	NA	NA	NA									
Growth	NA	NA	NA									
Thalassiosira												
Cell Density	<1	<1	<1									

Note: SJ Rounds 2-3 Secondary Effluent <1 TUc (SE not tested in SJ Round 1)

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TABLE 2. SJ/SC WPCP PILOT TOXICITY TESTING RESULTS
SAN JOSE/SANTA CLARA WPCP EFFLUENT AND RO REJECT BLENDS

	SJ Round 1 (Jul. 26, 2010)			*SJ Round 2 (Aug. 23-24, 2010)*			*SJ Round 3 (Oct. 12-13, 2010)*			*SJ Round 4 (Nov. 29-30, 2010)*		
Test Organism	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**	**100% Effluent**	**100% Effluent**	**100% Effluent**	**100% Effluent**	**98% Effluent + 2% RO Reject**	**91% Effluent + 9% RO Reject**	**100% Effluent**	**100% Effluent**	**100% Effluent**
Acute Toxicity (% Survival)												
Rainbow Trout	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Menidia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chronic Toxicity (TUc)												
Menidia												
Survival	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fathead Minnow												
Survival	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ceriodaphnia												
Survival	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalassiosira												
Cell Density	<1	**1.4**	**1.5**	<1	<1	<1	<1	<1	<1	<1	<1	<1

Note: SJ Round 4 Secondary Effluent 1.3 TUc

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Attachment C

Flow Balance Model – Pathways

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Attachment C: Flow Balance Model - Pathways

C.1. Introduction

A flow and mass balance model was created to model the magnitude and TDS of the flows which the SJ/SC RWF, SVAWPC and AWPF(s) would need to produce to reach various future water reuse goals under varying configurations of treatment plants ("treatment scenarios"), and flow scenarios (see Section C.3). Each permutation of flow scenario and treatment scenario was considered separately.

Calculations were performed in Microsoft Excel using flow and mass balance equations. In scenarios where ROC was returned to the head of the plant, resulting in increasing TDS through the system, algebraic reduction and circular references with iterative calculations were utilized to determine the equilibrium point of the flows and TDS resulting from the various scenarios.

For a summary of results, refer to table C-4, which lists the maximum production capacities of facilities and resultant TDS for each treatment scenario across all of the considered flow scenarios.

C.2. Treatment Scenarios

Treatment scenarios describe the configuration of AWPF, the treatment option being considered for that scenario, and where the SVAWPC and AWPF delivered ROC, if applicable. The configurations and treatment options which were modeled as a flow balance are listed in Table C-4 and illustrated in Figures C-1 through C-7. Assumptions involved in modeling the various treatment options are discussed in Section C-3.

C.2.1 IPR

For a given treatment scenario, the amount of IPR which the model calculated flows in order to deliver is based on either the maximum discharge allowable for the treatment option being considered (as shown in Table C-1), or the District stated goals of 25,000 AFY for 2025 and 35,000 AFY for 2035. If the maximum discharge allowable exceeded the District's stated goal for the time period considered, then the model sized the flows to deliver only the District stated goal. For example, with FAT, the assumed maximum allowable discharge is 31.2-mgd (equivalent to 34,900-AFY). For example, when modelling FAT (treatment option two) for 2025, the model calculated flows and TDS based on only 25,000-AFY of IPR, as the allowable amount exceeded the District stated goal.

Table C-1: IPR Maximum Discharge Based on Pathway and Treatment

	Pathway 1: GWR with Centralized Plants		Pathway 2: GWR with Satellite Plants		IPR TDS (mg/L)
Treatment Option	**AFY**	**mgd**	**AFY**	**mgd**	
Option 1: MF-RO Disinfection	18,180	16.2	25,425	22.7 [b]	50
Option 2: FAT	36,868	32.9[b,c]	37,342	33.3 [b,c]	
Option3: Ozone-BAC[a]	10,100	9.0	14,125	12.6	500

a: Note that Pathway 1, option 3 also includes a sidestream MF/RO process in the AWPF, which would blend with the Ozone-BAC discharge, to reduce the TDS to 500 mg/L. Under pathway 2 option 3 (satellite AWPF with Ozone-BAC), the AWPF influent is assumed to already be at 500-mg/L.
b: This flow exceeds the District's stated 2025 goal of 25,000 AFY. 25,000-AFY of IPR is thus used in the model instead of this value during 2025.
c: This flow exceeds the District's stated 2035 goal of 35,000 AFY. 35,000-AFY of IPR is thus used in the model instead of this value.

NPR is discussed under C.4.3.

C.3. Assumptions Regarding Treatment Processes

The treatment processes were modeled based on the following assumptions.

- Both the RWF and tertiary plant were assumed to have losses equal to five percent of their influent flows.
  - Assuming a larger value would decrease the flows to the outfall, and thus increase the TDS of the outfall.
- Only MF and RO processes were modeled for FAT plants
  - SVAWPC and FAT MF processes were assumed to discharge 95% of the plant influent flow as treated water, with five percent to return to the SJ/SC RWF as backwash. In Pathway 1, this backwash would be conveyed through on-site piping; in Pathway 2, the backwash would be conveyed through the sewer.
    - Assuming a larger value would increase the flows through the centralized plants, and decrease the flows needed by the satellite plants, thus decreasing the flows to the NPR network.
  - RO processes were assumed to recover 85% of the MF product at 50-mg/L of TDS regardless of influent TDS. The remaining 15% of the influent flow being discharged as concentrate.
    - Increasing this recovery percentage would:
      - Increase the flows through the tertiary plant and to outfall
      - Decrease the flows to the SCVAWPC and all AWPFs.
      - Increase the TDS of the concentrate

- Ozone BAC with side-stream RO treatment was modeled to yield an effluent TDS of 500-mg/L, which was the assumed value for maximum TDS for NPR, and IPR with the Option 3 treatment system.
  - Note that the satellite AWPF with Ozone BAC AND side-stream RO did not include an MF/RO train, as the influent into the NPR network was modeled to already be blended to 500-mg/L of TDS.
  - For centralized Ozone BAC with side-stream RO plants, the same assumptions regarding recovery percentages for FAT were made. Flows were sized based on the influent TDS, and effluent flow goal.
  - Allowing a larger TDS limit would:
    - Reduce the size of the SVAWPC RO train
    - Decrease the size of the sidestream MF/RO trains
    - Decrease outfall TDS in all scenarios
    - Increasing the TDS through the satellite AWPFs.
    - In situations where the RWF received RO concentrate, the RWF TDS would also decrease.

C.4. Flow Scenarios

Flow scenarios are a product of the year being considered (either 2025 or 2035), whether the RWF influent flow was the minimum, average or maximum anticipated, and whether it was a wet or dry season.

C.4.1 RWF Influent

Flows entering the system was the expected RWF influent, as supplied by the District.

For these flows, a minimum, average, and maximum value was provided by the District for 2025 and 2035. These values are shown in Table C-2. Note that the RWF influent is greater than this amount, due to some portion of the waste flows from the MF/RO treatment trains being returned to the RWF. For influent flows calculated by the model, refer to Table C-4 (for a summary) and Tables C-5 through C-8 for full results.

Influent TDS from the collection system was assumed to remain at 720-mg/L.

Table C-2: Influent Wastewater Flows (mgd)

Year:	**2025**	**2035**
Minimum	105	109
Average	115	124
Maximum	126	139

As the amount of flow going to NPR and IPR was constant, changing the wastewater flows only affected the flow and TDS to outfall. Larger influent flows result in lower TDS to the outfall. In scenarios where ROC is returned to the RWF, larger influent flows reduces TDS through the RWF and tertiary plants, and thus decreases the size of the sidestream MF/RO train for pathway one, option three.

C.4.2 Effluent Flows

Effluent flows from the system consisted of the following:

- IPR, as discussed in C.2.1.
- NPR, as discussed below
- Losses through the RWF, as discussed in section C.3.
- Losses through the tertiary treatment, as discussed in section C.3.
- Outfall, which amounted to the difference between the influent wastewater flow, and the effluent flows discussed above.

C.4.3 NPR

NPR was based on the District stated goal of 15,000 AFY, and was modeled to vary only based on the season (i.e. NPR was expected to remain constant regardless of year, pathway and treatment option). Seasonal adjustment was accounted for by using an adjustment factor based on the season to determine the NPR flow in mgd necessary to meet the anticipated demand. Refer to Table C-3. Larger NPR flows would increase the size of the SCVAWPC, and increase TDS to outfall.

Table C-3: NPR Usage

Season	Adjustment Factor	AFY equivalent	mgd equivalent
Dry	1.6	24,000	21.4
Wet	0.5	7,500	6.7

C.5. Conclusions

For a summary of conclusions, refer to Table C-4. For full results, refer to Tables C-5 through C-8.

The SCVAWPC's maximum flows occur during the dry season. Treatment scenarios where ROC is returned to the RWF require a larger SCVAWPC to accommodate. For treatment scenarios with satellite AWPFs, peak SCVAWPC flow occurs during maximum discharge of the AWPF. Refer to Table C-1.

RWF flows would be expected to increase by a maximum of 10 percent. In treatment scenarios where ROC was returned to the RWF, peak TDS through the RWF would occur during minimum sewer flows during dry seasons. For treatment options 1 and 3, this peak TDS is expected to occur during 2025 flows. For option 2 (centralized FAT), this peak TDS through the RWF occurs during 2035 flows, as there is a significant increase in IPR for that scenario from 2025 to 2035.

Table C-4: Summary of Model Results

Description of Flow Scenario				Summary of Results								Reference	
				Maximum Flows (in mgd)				TDS (in mg/L)					
Pathway	**Treatment Option**	**Location of SVAWPC ROC Discharge**	**Location of IPR AWPF ROC Discharge**	**IPR Flows [A]**	**SJ/SC RWF [B]**	**SVAWPC ROP [B]**	**AWPF ROP [B]**	**RWF/Tertiary Effluent, Maximum [B]**	**Outfall, Average [B]**	**Outfall, Maximum [B]**	**IPR [A]**	**Corresponding Figure Showing Flowchart**	**Table with Full Results**
1: Centralized AWPF	1: MF-RO w/ UV Disinfection	Outfall		16.2	140.4	7	16.2	720	904	987	50	Figure 1	6E-6
	2: FAT			22.5[C] / 31.2[E]	141.4	7	31.2	720	1,038	1,256			
	3: Ozone-BAC with Side-stream RO			9	140.7	7	3	720	782	823	500	Figure 2	
	1: MF-RO w/ UV Disinfection	RWF		16.2	145.2	10.7	16.2	951	882	951	50	Figure 3	6E-7
	2: FAT			22.5[C] / 31.2[E]	149.2	12.9	31.2	1,175	997	1,175			
	3: Ozone-BAC with Side-stream RO			9	142.9	8.7	3	810	775	810	500	Figure 4	
2: Satellite AWPF	1: MF-RO with UV Disinfection	Outfall	Sewers (to return to RWF)	22.5[C] / 22.7[D]	145.6	19.8	22.7[F]	800	970	1,084	50	Figure 5	6E-8
	2: FAT			22.5[C] / 31.2[E]	148	25.3	31.2[F]	827	1,031	1,250			
	3: Ozone-BAC	Outfall	NA	12.6	141.1	11.6	0[F]	718	796	843	500	Figure 6	
	1: MF-RO with UV Disinfection	Outfall		22.5[C] / 22.7[D]	141.4	16.2	22.7[F]	718	983	1,100	50	Figure 7	6E-9
	2: FAT			22.5[C] / 31.2[E]	142.1	19.6	31.2[F]	718	1,044	1,271			
				31.2[E]				718	1,044	1,271			

[A] These values were input into the model as a constraint.
[B] This value is an output of the model, which was determined based on the various inputs.
[C] This value represents IPR usage during 2025. At that time, IPR will not be limited by ground-water recharge capacity, but by IPR goals.
D This value represents IPR usage during 2035. It is limited by ground-water recharge capacity.
E This value represents IPR usage during 2035. It is limited by IPR goals.
F These values represent the combined flows from all of the satellite plants.

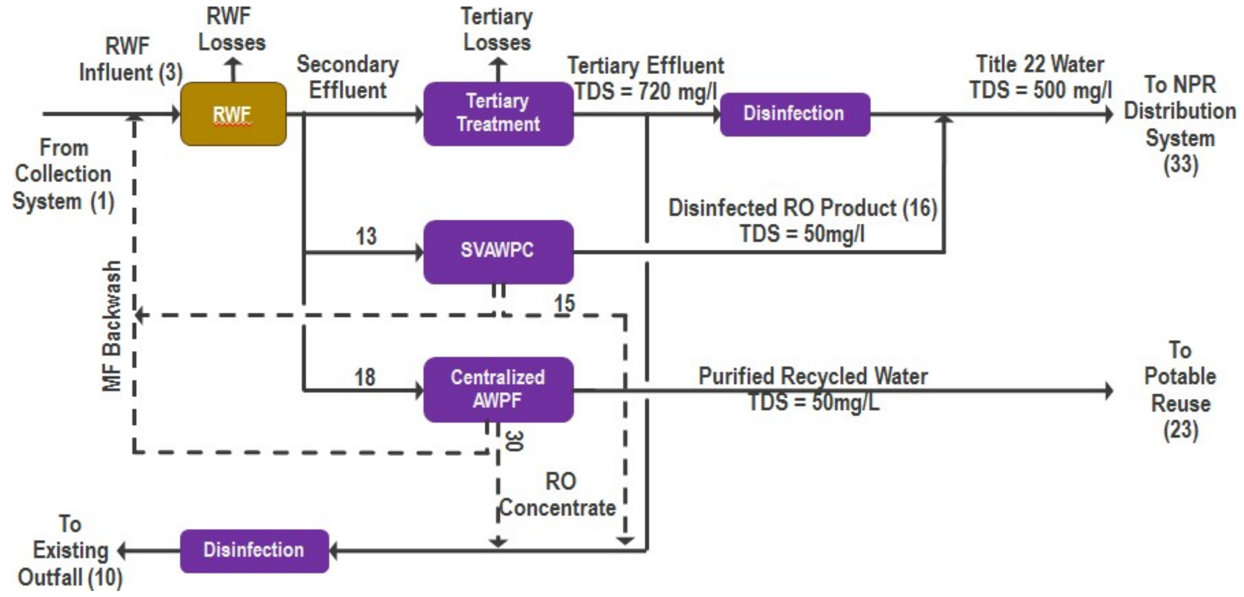

Figure C-1
Pathway 1, Options One and Two (Centralized AWPF with FAT); ROC to Outfall

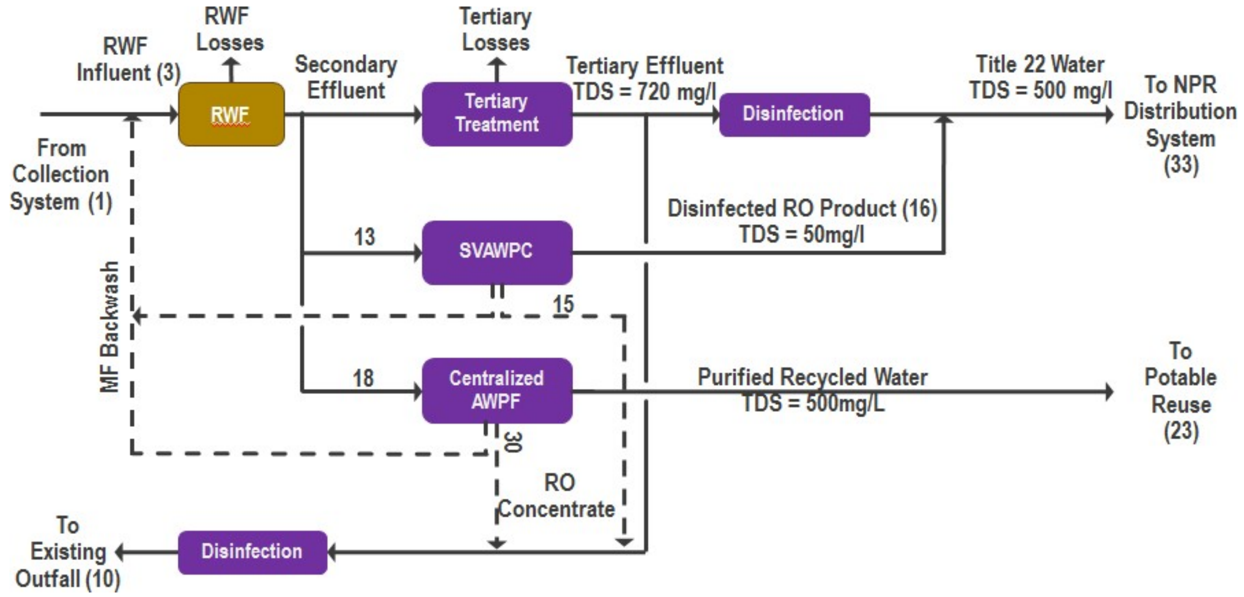

Figure C-2
Pathway 1, Option Three (Centralized AWPF with Ozone BAC & Side-stream RO); ROC to Outfall

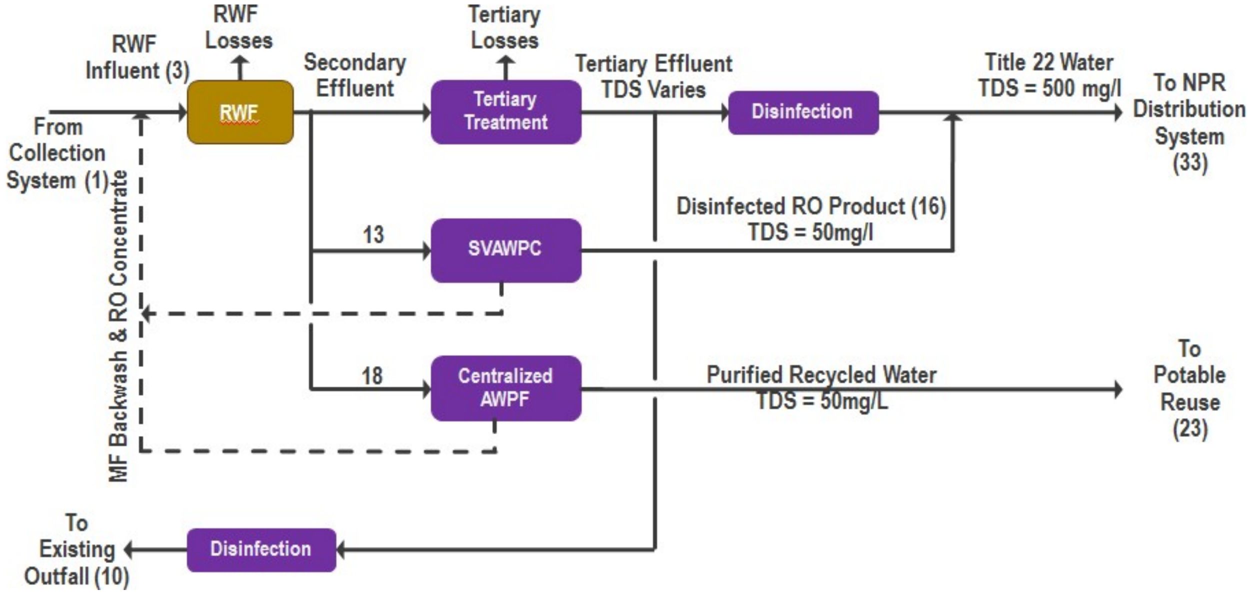
RWF Influent (3)
RWF Losses
Secondary Effluent
Tertiary Losses
Tertiary Effluent TDS Varies
Title 22 Water TDS = 500 mg/l
To NPR Distribution System (33)
RWF
Tertiary Treatment
Disinfection
From Collection System (1)
13
SVAWPC
Disinfected RO Product (16) TDS = 50mg/l
MF Backwash & RO Concentrate
18
Centralized AWPF
Purified Recycled Water TDS = 50mg/L
To Potable Reuse (23)
To Existing Outfall (10)
Disinfection

Figure C-3
Pathway 1, Options One and Two (Centralized AWPF with FAT); ROC to RWF

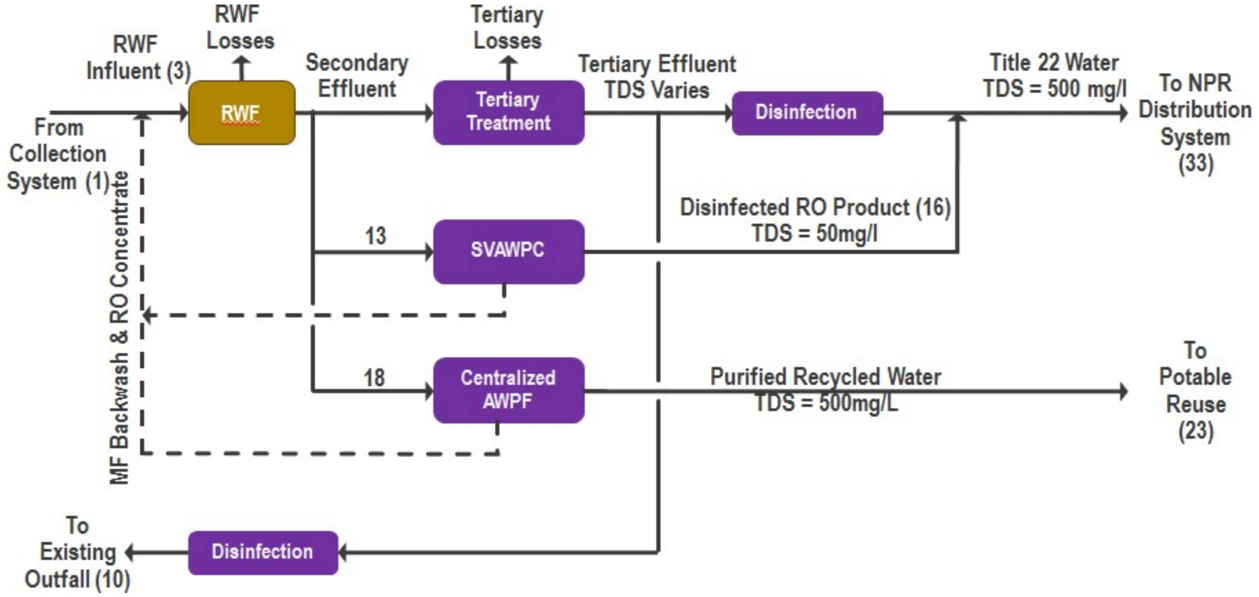
RWF Influent (3)
RWF Losses
Secondary Effluent
Tertiary Losses
Tertiary Effluent TDS Varies
Title 22 Water TDS = 500 mg/l
To NPR Distribution System (33)
RWF
Tertiary Treatment
Disinfection
From Collection System (1)
13
SVAWPC
Disinfected RO Product (16) TDS = 50mg/l
MF Backwash & RO Concentrate
18
Centralized AWPF
Purified Recycled Water TDS = 500mg/L
To Potable Reuse (23)
To Existing Outfall (10)
Disinfection

Figure C-4
Pathway 1, Option Three (Centralized AWPF with Ozone-BAC & Side-stream RO); ROC to RWF

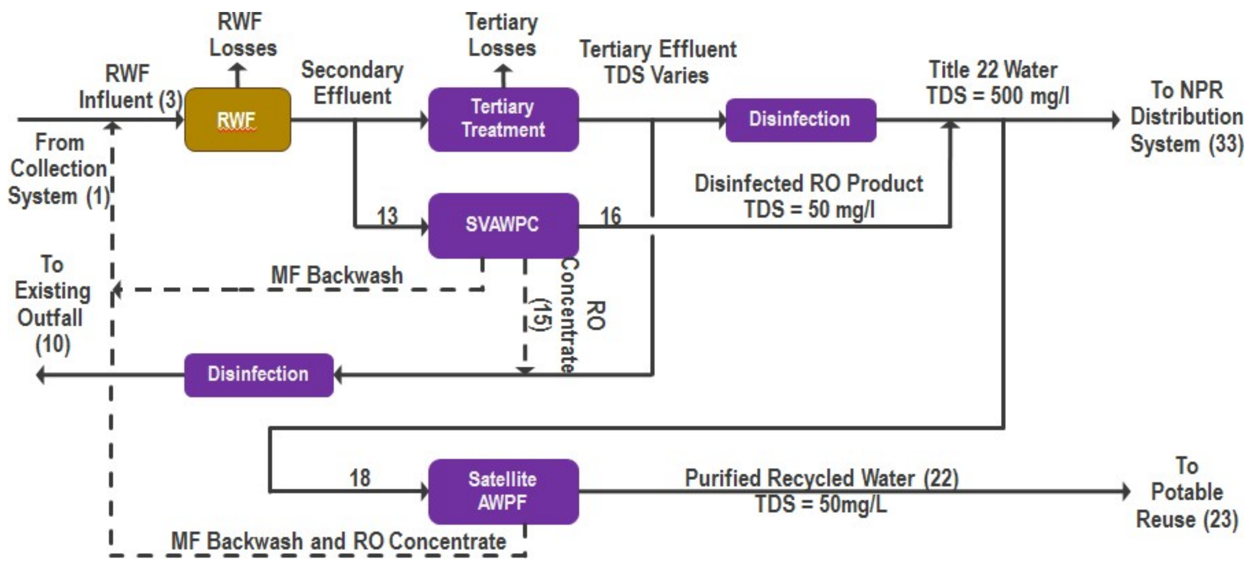
RWF Losses
RWF Influent (3)
RWF
Secondary Effluent
Tertiary Losses
Tertiary Treatment
Tertiary Effluent TDS Varies
Disinfection
Title 22 Water TDS = 500 mg/l
To NPR Distribution System (33)
From Collection System (1)
13
SVAWPC
16
Disinfected RO Product TDS = 50 mg/l
To Existing Outfall (10)
MF Backwash
RO Concentrate (15)
Disinfection
18
Satellite AWPF
Purified Recycled Water (22) TDS = 50mg/L
To Potable Reuse (23)
MF Backwash and RO Concentrate

Figure C-5
Pathway 2, Options One and Two (Satellite AWPF with FAT)
SVAWPC ROC to Outfall, Satellite AWPF ROC to RWF

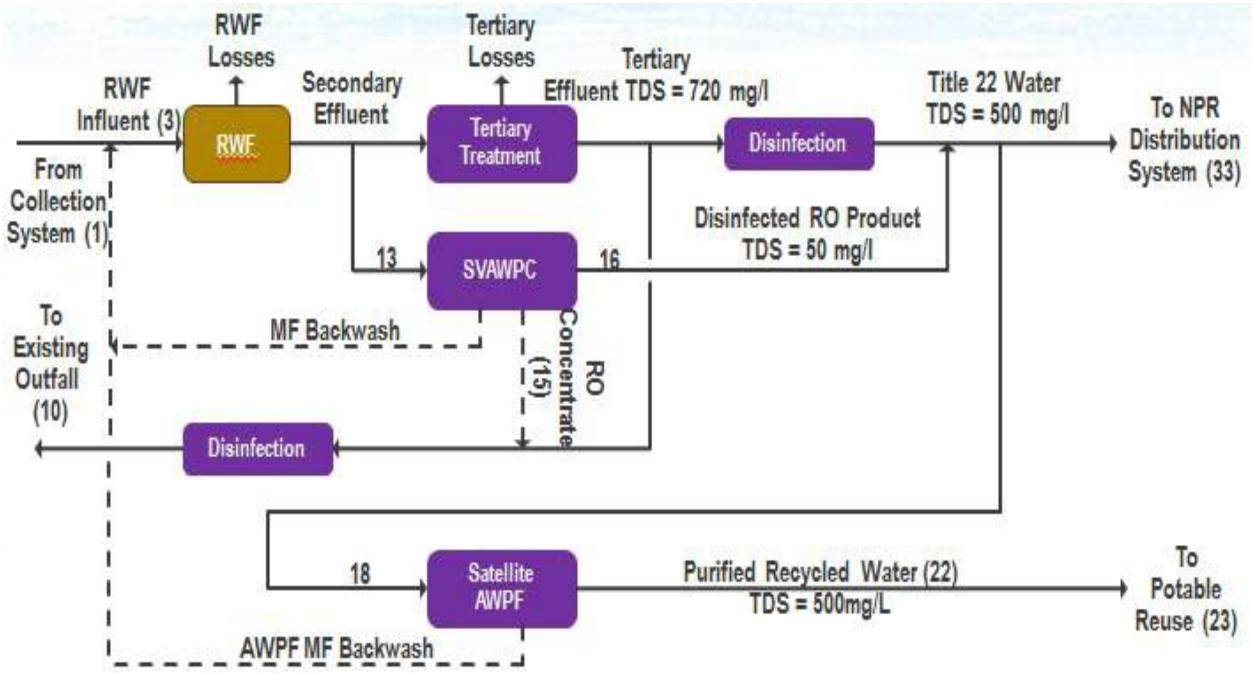

Figure C-6
Pathway 2, Option Three (Satellite AWPF with Ozone BAC & Sidestream RO)
SVAWPC ROC to Outfall

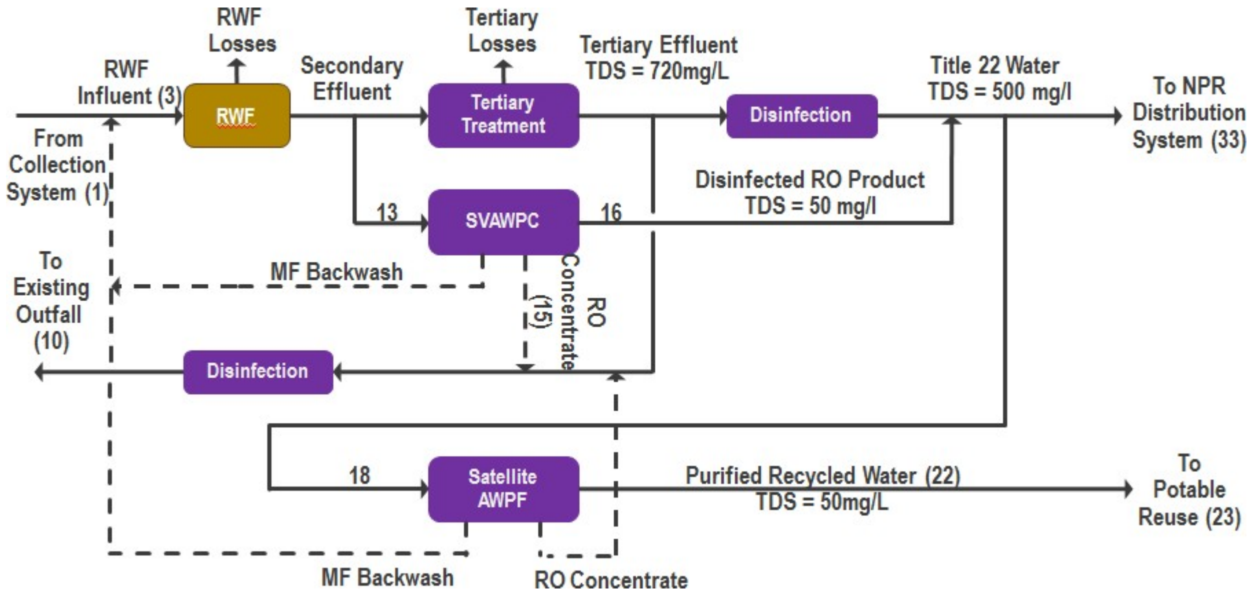

Figure C-7
Pathway 2, Options One and Two (Satellite AWPF with FAT)
SVAWPC and Satellite AWPF ROC Discharging Continuously to Outfall

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Table 6CE-5 - Pathway 1, GWR with Centralized Plants
RO Concentrate Discharging to Outfall

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2025, Minimum Flow, Dry Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	119,200	106.4	720	119,700	106.8	720	119,500	106.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	65,400	58.4	987	59,000	52.7	1,093	73,000	65.1	823
% RO Concentrate Sent Directly to Outfall	36	7%			10%			3%		
2025, Minimum Flow, Wet Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	118,900	106.1	720	119,300	106.5	720	119,200	106.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	81,600	72.9	889	75,200	67.1	965	89,200	79.6	763
% RO Concentrate Sent Directly to Outfall	36	4%			6%			1%		
2025, Average Flow, Dry Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	130,400	116.4	720	130,900	116.8	720	130,700	116.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	75,500	67.4	951	69,100	61.7	1,039	83,100	74.2	810
% RO Concentrate Sent Directly to Outfall	36	6%			8%			2%		
2025, Average Flow, Wet Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	130,100	116.1	720	130,500	116.5	720	130,400	116.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	91,700	81.9	871	85,300	76.1	936	99,300	88.6	759
% RO Concentrate Sent Directly to Outfall	36	4%			6%			1%		
2025, Maximum Flow, Dry Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	142,800	127.4	720	143,200	127.8	720	143,000	127.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	86,700	77.4	921	80,200	71.6	995	94,200	84.1	800
% RO Concentrate Sent Directly to Outfall	36	5%			7%			2%		
2025, Maximum Flow, Wet Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	142,400	127.1	720	142,800	127.5	720	142,700	127.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	31,000	27.6	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	4,400	3.9	4,517	600	0.5	4,517
Outfall	10	102,900	91.8	854	96,400	86.1	911	110,400	98.5	755
% RO Concentrate Sent Directly to Outfall	36	4%			5%			1%		

Table 6CE-5 - Pathway 1, GWR with Centralized Plants
RO Concentrate Discharging to Outfall

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2035, Minimum Flow, Dry Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	123,700	110.4	720	124,800	111.4	720	124,000	110.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	69,500	62.0	971	53,600	47.8	1,256	77,000	68.7	817
% RO Concentrate Sent Directly to Outfall	36	7%			14%			3%		
2035, Minimum Flow, Wet Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	123,400	110.1	720	124,400	111.1	720	123,700	110.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	85,700	76.5	881	69,800	62.3	1,080	93,200	83.2	762
% RO Concentrate Sent Directly to Outfall	36	4%			9%			1%		
2035, Average Flow, Dry Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	140,500	125.4	720	141,600	126.4	720	140,800	125.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	84,600	75.6	926	68,800	61.4	1,138	92,200	82.3	801
% RO Concentrate Sent Directly to Outfall	36	5%			11%			2%		
2035, Average Flow, Wet Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	140,200	125.1	720	141,200	126.1	720	140,500	125.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	100,800	90.0	857	84,900	75.8	1,015	108,400	96.7	756
% RO Concentrate Sent Directly to Outfall	36	4%			8%			1%		
2035, Maximum Flow, Dry Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	157,300	140.4	720	158,400	141.4	720	157,600	140.7	720
SVAWPC Influent	13	9,800	8.7	720	9,800	8.7	720	9,800	8.7	720
SVAWPC ROP	16	7,900	7.0	50	7,900	7.0	50	7,900	7.0	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,400	1.2	4,517	1,400	1.2	4,517	1,400	1.2	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	99,800	89.1	895	83,900	74.9	1,062	107,300	95.8	790
% RO Concentrate Sent Directly to Outfall	36	5%			9%			2%		
2035, Maximum Flow, Wet Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	157,000	140.1	720	158,000	141.1	720	157,300	140.4	720
SVAWPC Influent	13	3,000	2.7	720	3,000	2.7	720	3,000	2.7	720
SVAWPC ROP	16	2,500	2.2	50	2,500	2.2	50	2,500	2.2	50
AWPF Influent	18	22,500	20.1	720	43,300	38.7	720	12,100	10.8	720
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,300	3.0	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	400	0.4	4,517	400	0.4	4,517	400	0.4	4,517
AWPF RO Concentrate	30	3,200	2.9	4,517	6,200	5.5	4,517	600	0.5	4,517
Outfall	10	116,000	103.6	839	100,100	89.4	971	123,500	110.3	751
% RO Concentrate Sent Directly to Outfall	36	3%			7%			1%		

Table 6CE-6 - Pathway 1: GWR with Centralized Plants
RO Concentrate Discharging to RWF

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2025, Minimum Flow, Dry Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	124,800	111.4	951	126,700	113.1	1,041	122,200	109.1	810
SVAWPC Influent	13	14,900	13.3	951	16,200	14.5	1,041	12,100	10.8	810
SVAWPC ROP	16	12,000	10.7	50	13,100	11.7	50	9,800	8.7	50
AWPF Influent	18	22,500	20.1	951	31,000	27.6	1,041	12,300	11.0	810
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	4,100	3.7	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	2,100	1.9	6,060	2,300	2.1	6,657	1,700	1.5	5,116
AWPF RO Concentrate	30	3,200	2.9	6,060	4,400	3.9	6,657	700	0.6	5,116
Outfall	10	65,100	58.1	951	58,600	52.3	1,041	72,800	65.0	810
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2025, Minimum Flow, Wet Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	122,800	109.6	870	124,500	111.1	936	120,400	107.5	759
SVAWPC Influent	13	4,200	3.7	870	4,600	4.1	936	3,400	3.0	759
SVAWPC ROP	16	3,400	3.0	50	3,700	3.3	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	870	31,000	27.6	936	12,200	10.9	759
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,700	3.3	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,520	700	0.6	5,958	500	0.4	4,775
AWPF RO Concentrate	30	3,200	2.9	5,520	4,400	3.9	5,958	700	0.6	4,775
Outfall	10	81,300	72.6	870	74,800	66.7	936	89,100	79.5	759
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2025, Average Flow, Dry Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	135,900	121.3	922	137,800	123.0	996	133,300	119.0	799
SVAWPC Influent	13	14,400	12.8	922	15,600	13.9	996	11,900	10.6	799
SVAWPC ROP	16	11,600	10.4	50	12,600	11.2	50	9,600	8.6	50
AWPF Influent	18	22,500	20.1	922	31,000	27.6	996	12,300	11.0	799
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	4,000	3.6	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	2,000	1.8	5,860	2,200	2.0	6,357	1,700	1.5	5,045
AWPF RO Concentrate	30	3,200	2.9	5,860	4,400	3.9	6,357	700	0.6	5,045
Outfall	10	75,200	67.2	922	68,700	61.3	996	82,900	74.0	799
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2025, Average Flow, Wet Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	133,900	119.6	854	135,600	121.1	911	131,600	117.4	755
SVAWPC Influent	13	4,100	3.7	854	4,400	4.0	911	3,400	3.0	755
SVAWPC ROP	16	3,300	2.9	50	3,600	3.2	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	854	31,000	27.6	911	12,200	10.9	755
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,700	3.3	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,411	600	0.6	5,790	500	0.4	4,749
AWPF RO Concentrate	30	3,200	2.9	5,411	4,400	3.9	5,790	600	0.6	4,749
Outfall	10	91,400	81.6	854	84,900	75.8	911	99,200	88.5	755
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2025, Maximum Flow, Dry Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	148,200	132.3	896	150,000	133.9	959	145,600	129.9	790
SVAWPC Influent	13	13,900	12.4	896	15,000	13.4	959	11,600	10.4	790
SVAWPC ROP	16	11,200	10.0	50	12,100	10.8	50	9,400	8.4	50
AWPF Influent	18	22,500	20.1	896	31,000	27.6	959	12,300	11.0	790
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	4,000	3.5	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	2,000	1.8	5,693	2,100	1.9	6,111	1,700	1.5	4,984
AWPF RO Concentrate	30	3,200	2.9	5,693	4,400	3.9	6,111	700	0.6	4,984
Outfall	10	86,300	77.1	896	79,800	71.3	959	94,000	84.0	790
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2025, Maximum Flow, Wet Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	146,200	130.6	840	147,900	132.1	889	143,900	128.4	751
SVAWPC Influent	13	4,000	3.6	840	4,300	3.8	889	3,300	3.0	751
SVAWPC ROP	16	3,200	2.9	50	3,500	3.1	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	840	31,000	27.6	889	12,200	10.9	751
Total AWPF ROP	22	18,200	16.2	50	25,000	22.3	50	3,600	3.2	50
Total Potable Re-use	23	18,200	16.2	50	25,000	22.3	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,315	600	0.5	5,646	500	0.4	4,726
AWPF RO Concentrate	30	3,200	2.9	5,315	4,400	3.9	5,646	600	0.6	4,726
Outfall	10	102,500	91.5	840	96,000	85.7	889	110,300	98.5	751
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		

Table 6CE-6 - Pathway 1: GWR with Centralized Plants
RO Concentrate Discharging to RWF

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2035, Minimum Flow, Dry Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	129,300	115.4	938	133,900	119.5	1,175	126,600	113.0	805
SVAWPC Influent	13	14,700	13.1	938	17,800	15.9	1,175	12,000	10.7	805
SVAWPC ROP	16	11,800	10.6	50	14,400	12.9	50	9,700	8.7	50
AWPF Influent	18	22,500	20.1	938	43,300	38.7	1,175	12,300	11.0	805
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	4,100	3.6	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	2,100	1.9	5,973	2,500	2.3	7,552	1,700	1.5	5,085
AWPF RO Concentrate	30	3,200	2.9	5,973	6,200	5.5	7,552	700	0.6	5,085
Outfall	10	69,200	61.8	938	53,100	47.4	1,175	76,900	68.6	805
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2035, Minimum Flow, Wet Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	127,200	113.6	863	131,400	117.3	1,035	124,800	111.5	757
SVAWPC Influent	13	4,100	3.7	863	5,000	4.5	1,035	3,400	3.0	757
SVAWPC ROP	16	3,400	3.0	50	4,100	3.6	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	863	43,300	38.7	1,035	12,200	10.9	757
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,700	3.3	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,473	700	0.6	6,619	500	0.4	4,764
AWPF RO Concentrate	30	3,200	2.9	5,473	6,200	5.5	6,619	600	0.6	4,764
Outfall	10	85,300	76.2	863	69,200	61.8	1,035	93,100	83.1	757
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2035, Average Flow, Dry Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	145,900	130.3	901	150,500	134.3	1,080	143,300	127.9	792
SVAWPC Influent	13	14,000	12.5	901	16,700	14.9	1,080	11,700	10.4	792
SVAWPC ROP	16	11,300	10.1	50	13,500	12.1	50	9,400	8.4	50
AWPF Influent	18	22,500	20.1	901	43,300	38.7	1,080	12,300	11.0	792
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	4,000	3.5	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	2,000	1.8	5,720	2,400	2.1	6,914	1,700	1.5	4,994
AWPF RO Concentrate	30	3,200	2.9	5,720	6,200	5.5	6,914	700	0.6	4,994
Outfall	10	84,300	75.3	901	68,200	60.9	1,080	92,000	82.2	792
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2035, Average Flow, Wet Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	144,000	128.6	842	148,200	132.3	980	141,600	126.4	752
SVAWPC Influent	13	4,000	3.6	842	4,800	4.3	980	3,300	3.0	752
SVAWPC ROP	16	3,200	2.9	50	3,900	3.5	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	842	43,300	38.7	980	12,200	10.9	752
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,600	3.2	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,331	700	0.6	6,253	500	0.4	4,729
AWPF RO Concentrate	30	3,200	2.9	5,331	6,200	5.5	6,253	600	0.6	4,729
Outfall	10	100,500	89.7	842	84,400	75.3	980	108,300	96.7	752
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2035, Maximum Flow, Dry Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	162,600	145.2	874	167,100	149.2	1,017	160,100	142.9	782
SVAWPC Influent	13	13,500	12.0	874	15,900	14.2	1,017	11,400	10.2	782
SVAWPC ROP	16	10,900	9.7	50	12,800	11.5	50	9,200	8.2	50
AWPF Influent	18	22,500	20.1	874	43,300	38.7	1,017	12,300	10.9	782
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,900	3.5	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	1,900	1.7	5,542	2,300	2.0	6,497	1,600	1.5	4,928
AWPF RO Concentrate	30	3,200	2.9	5,542	6,200	5.5	6,497	700	0.6	4,928
Outfall	10	99,500	88.8	874	83,400	74.4	1,017	107,200	95.7	782
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		
2035, Maximum Flow, Wet Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	160,800	143.5	826	164,900	147.2	942	158,400	141.4	748
SVAWPC Influent	13	3,900	3.5	826	4,600	4.1	942	3,300	2.9	748
SVAWPC ROP	16	3,200	2.8	50	3,700	3.3	50	2,700	2.4	50
AWPF Influent	18	22,500	20.1	826	43,300	38.7	942	12,200	10.9	748
Total AWPF ROP	22	18,200	16.2	50	35,000	31.2	50	3,600	3.2	50
Total Potable Re-use	23	18,200	16.2	50	35,000	31.2	50	10,100	9.0	500
% of Potable Re-use Goal Reached	39	52%			100%			29%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	600	0.5	5,226	700	0.6	5,995	500	0.4	4,704
AWPF RO Concentrate	30	3,200	2.9	5,226	6,200	5.5	5,995	600	0.6	4,704
Outfall	10	115,700	103.3	826	99,500	88.8	942	123,400	110.2	748
% RO Concentrate Sent Directly to Outfall	36	0%			0%			0%		

Table 6E-7 - Pathway 2, GWR with Satellite Plants
SVAWPC RO Concentrate Discharging to Outfall, Satellite RO Concentrate Discharging Continuously to Sewers

Flow Description	Flow Description	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2025, Minimum Flow, Dry Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	124,900	111.5	800	124,900	111.5	800	120,000	107.1	717
SVAWPC Influent	13	27,200	24.3	800	27,200	24.3	800	16,000	14.3	717
SVAWPC ROP	16	22,000	19.6	50	22,000	19.6	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,900	3.5	5,053	3,900	3.5	5,053	2,300	2.0	4,497
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	58,300	52.0	1,084	57,800	51.6	1,086	68,600	61.2	843
% RO Concentrate Sent Directly to Outfall	36	7%			7%			3%		
2025, Minimum Flow, Wet Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	124,500	111.2	800	124,500	111.2	800	119,700	106.8	717
SVAWPC Influent	13	19,100	17.0	800	19,100	17.0	800	9,300	8.3	717
SVAWPC ROP	16	15,400	13.7	50	15,400	13.7	50	7,500	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,700	2.4	5,053	2,700	2.4	5,053	1,300	1.2	4,497
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	74,400	66.5	956	73,900	66.0	957	84,800	75.7	776
% RO Concentrate Sent Directly to Outfall	36	4%			4%			2%		
2025, Average Flow, Dry Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	136,100	121.5	794	136,100	121.5	794	131,200	117.1	717
SVAWPC Influent	13	26,900	24.0	794	26,900	24.0	794	16,000	14.3	717
SVAWPC ROP	16	21,700	19.4	50	21,700	19.4	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,800	3.4	5,008	3,800	3.4	5,008	2,300	2.0	4,499
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	68,400	61.1	1,030	67,900	60.6	1,032	78,700	70.3	827
% RO Concentrate Sent Directly to Outfall	36	6%			6%			3%		
2025, Average Flow, Wet Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	135,700	121.2	794	135,700	121.2	794	130,900	116.8	717
SVAWPC Influent	13	18,800	16.8	794	18,800	16.8	794	9,400	8.4	717
SVAWPC ROP	16	15,200	13.6	50	15,200	13.6	50	7,600	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,700	2.4	5,008	2,700	2.4	5,008	1,300	1.2	4,499
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	84,600	75.5	927	84,000	75.0	928	94,900	84.7	770
% RO Concentrate Sent Directly to Outfall	36	3%			3%			1%		
2025, Maximum Flow, Dry Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	148,400	132.5	788	148,400	132.5	788	143,500	128.1	718
SVAWPC Influent	13	26,500	23.7	788	26,500	23.7	788	16,000	14.3	718
SVAWPC ROP	16	21,400	19.1	50	21,400	19.1	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,800	3.4	4,967	3,800	3.4	4,967	2,300	2.0	4,501
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	79,600	71.1	986	79,000	70.5	988	89,800	80.2	814
% RO Concentrate Sent Directly to Outfall	36	5%			5%			3%		
2025, Maximum Flow, Wet Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	148,000	132.1	788	148,000	132.1	788	143,200	127.8	718
SVAWPC Influent	13	18,600	16.6	788	18,600	16.6	788	9,400	8.4	718
SVAWPC ROP	16	15,000	13.4	50	15,000	13.4	50	7,600	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50	0		
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	100%			100%			57%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,600	2.4	4,967	2,600	2.4	4,967	1,300	1.2	4,501
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050	0		
Outfall	10	95,800	85.5	903	95,100	84.9	904	106,000	94.6	765
% RO Concentrate Sent Directly to Outfall	36	3%			3%			1%		

Table 6E-7 - Pathway 2, GWR with Satellite Plants
SVAWPC RO Concentrate Discharging to Outfall, Satellite RO Concentrate Discharging Continuously to Sewers

Flow Description	Flow Description	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2035, Minimum Flow, Dry Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	129,500	115.6	799	132,200	118.0	827	124,500	111.1	717
SVAWPC Influent	13	27,400	24.5	799	35,100	31.3	827	16,000	14.3	717
SVAWPC ROP	16	22,100	19.8	50	28,300	25.3	50	12,900	11.5	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,900	3.5	5,042	5,000	4.5	5,228	2,300	2.0	4,498
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	61,900	55.3	1,067	52,000	46.4	1,250	72,600	64.8	836
% RO Concentrate Sent Directly to Outfall	36	6%			10%			3%		
2035, Minimum Flow, Wet Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	129,100	115.3	799	131,800	117.6	827	124,100	110.8	717
SVAWPC Influent	13	19,300	17.2	799	26,500	23.6	827	9,400	8.3	717
SVAWPC ROP	16	15,600	13.9	50	21,400	19.1	50	7,600	6.7	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,700	2.5	5,042	3,800	3.4	5,228	1,300	1.2	4,498
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	78,100	69.7	948	68,100	60.8	1,071	88,800	79.3	774
% RO Concentrate Sent Directly to Outfall	36	4%			6%			2%		
2035, Average Flow, Dry Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	146,300	130.6	790	149,000	133.0	815	141,300	126.1	718
SVAWPC Influent	13	26,900	24.0	790	34,300	30.6	815	16,000	14.3	718
SVAWPC ROP	16	21,700	19.4	50	27,700	24.7	50	12,900	11.5	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,800	3.4	4,982	4,900	4.4	5,147	2,300	2.0	4,500
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	77,200	68.9	998	67,100	59.9	1,130	87,800	78.4	816
% RO Concentrate Sent Directly to Outfall	36	5%			7%			3%		
2035, Average Flow, Wet Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	145,900	130.3	790	148,500	132.6	815	140,900	125.8	718
SVAWPC Influent	13	18,900	16.9	790	25,900	23.1	815	9,400	8.4	718
SVAWPC ROP	16	15,300	13.6	50	20,900	18.7	50	7,600	6.7	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,700	2.4	4,982	3,700	3.3	5,147	1,300	1.2	4,500
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	93,300	83.3	911	83,200	74.3	1,007	104,000	92.8	766
% RO Concentrate Sent Directly to Outfall	36	3%			4%			1%		
2035, Maximum Flow, Dry Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	163,100	145.6	782	165,700	148.0	805	158,100	141.1	718
SVAWPC Influent	13	26,500	23.7	782	33,700	30.1	805	16,000	14.3	718
SVAWPC ROP	16	21,400	19.1	50	27,200	24.3	50	12,900	11.6	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,800	3.4	4,933	4,800	4.3	5,082	2,300	2.0	4,502
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	92,400	82.5	952	82,200	73.4	1,054	103,000	91.9	802
% RO Concentrate Sent Directly to Outfall	36	4%			6%			2%		
2035, Maximum Flow, Wet Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	162,700	145.2	782	165,300	147.6	805	157,700	140.8	718
SVAWPC Influent	13	18,600	16.6	782	25,400	22.7	805	9,400	8.4	718
SVAWPC ROP	16	15,000	13.4	50	20,500	18.3	50	7,600	6.8	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,700	2.4	4,933	3,600	3.2	5,082	1,300	1.2	4,502
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0		
Outfall	10	108,500	96.9	884	98,400	87.8	962	119,200	106.4	760
% RO Concentrate Sent Directly to Outfall	36	2%			4%			1%		

Table 6E-8 - Pathway 2, GWR with Satellite Plants
RO Concentrate Discharging Continuously to Outfall

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2025, Minimum Flow, Dry Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	120,300	107.4	717	120,300	107.4	717	120,000	107.1	717
SVAWPC Influent	13	22,200	19.8	717	22,200	19.8	717	16,000	14.3	717
SVAWPC ROP	16	17,900	16.0	50	17,900	16.0	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.8	4,498	3,200	2.8	4,498	2,300	2.0	4,497
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	58,000	51.8	1,100	58,000	51.8	1,100	68,600	61.2	843
% RO Concentrate Sent Directly to Outfall	36		13%			13%			3%	
2025, Minimum Flow, Wet Season										
Wastewater Collected	1	117,600	105.0	720	117,600	105.0	720	117,600	105.0	720
SJ/SC RWF Influent	3	119,900	107.1	717	119,900	107.1	717	119,700	106.8	717
SVAWPC Influent	13	15,500	13.8	717	15,500	13.8	717	9,300	8.3	717
SVAWPC ROP	16	12,500	11.2	50	12,500	11.2	50	7,500	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,498	2,200	2.0	4,498	1,300	1.2	4,497
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	74,200	66.2	968	74,200	66.2	968	84,800	75.7	776
% RO Concentrate Sent Directly to Outfall	36		9%			9%			2%	
2025, Average Flow, Dry Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	131,500	117.4	717	131,500	117.4	717	131,200	117.1	717
SVAWPC Influent	13	22,200	19.8	717	22,200	19.8	717	16,000	14.3	717
SVAWPC ROP	16	17,900	16.0	50	17,900	16.0	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.8	4,499	3,200	2.8	4,499	2,300	2.0	4,499
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	68,100	60.8	1,044	68,100	60.8	1,044	78,700	70.3	827
% RO Concentrate Sent Directly to Outfall	36		11%			11%			3%	
2025, Average Flow, Wet Season										
Wastewater Collected	1	128,800	115.0	720	128,800	115.0	720	128,800	115.0	720
SJ/SC RWF Influent	3	131,100	117.1	717	131,100	117.1	717	130,900	116.8	717
SVAWPC Influent	13	15,500	13.8	717	15,500	13.8	717	9,400	8.4	717
SVAWPC ROP	16	12,500	11.2	50	12,500	11.2	50	7,600	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,499	2,200	2.0	4,499	1,300	1.2	4,499
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	84,300	75.3	939	84,300	75.3	939	94,900	84.7	770
% RO Concentrate Sent Directly to Outfall	36		8%			8%			1%	
2025, Maximum Flow, Dry Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	143,800	128.4	718	143,800	128.4	718	143,500	128.1	718
SVAWPC Influent	13	22,200	19.8	718	22,200	19.8	718	16,000	14.3	718
SVAWPC ROP	16	17,900	16.0	50	17,900	16.0	50	12,900	11.5	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.8	4,501	3,200	2.8	4,501	2,300	2.0	4,501
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	79,200	70.7	998	79,200	70.7	998	89,800	80.2	814
% RO Concentrate Sent Directly to Outfall	36		10%			10%			3%	
2025, Maximum Flow, Wet Season										
Wastewater Collected	1	141,100	126.0	720	141,100	126.0	720	141,100	126.0	720
SJ/SC RWF Influent	3	143,500	128.1	718	143,500	128.1	718	143,200	127.8	718
SVAWPC Influent	13	15,500	13.9	718	15,500	13.9	718	9,400	8.4	718
SVAWPC ROP	16	12,500	11.2	50	12,500	11.2	50	7,600	6.7	50
AWPF Influent	18	31,000	27.6	500	31,000	27.6	500	15,700	14.0	500
Total AWPF ROP	22	25,000	22.3	50	25,000	22.3	50		0.0	
Total Potable Re-use	23	25,000	22.3	50	25,000	22.3	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39		100%			100%			57%	
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,501	2,200	2.0	4,501	1,300	1.2	4,501
AWPF RO Concentrate	30	4,400	3.9	3,050	4,400	3.9	3,050		0.0	
Outfall	10	95,400	85.2	913	95,400	85.2	913	106,000	94.6	765
% RO Concentrate Sent Directly to Outfall	36		7%			7%			1%	

Table 6E 8 - Pathway 2, GWR with Satellite Plants
RO Concentrate Discharging Continuously to Outfall

Flow Description	Flow #	Option 1: MF-RO with UV Disinfection			Option 2: FAT			Option 3: Ozone-BAC		
		Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L	Rate, AFY (equiv.)	Rate, mgd	TDS, mg/L
2035, Minimum Flow, Dry Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	124,800	111.4	717	125,600	112.1	716	124,500	111.1	717
SVAWPC Influent	13	22,400	20.0	717	27,100	24.2	716	16,000	14.3	717
SVAWPC ROP	16	18,100	16.1	50	21,900	19.5	50	12,900	11.5	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.8	4,498	3,900	3.4	4,491	2,300	2.0	4,498
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	61,600	55.0	1,083	52,200	46.6	1,271	72,600	64.8	836
% RO Concentrate Sent Directly to Outfall	36	12%			19%			3%		
2035, Minimum Flow, Wet Season										
Wastewater Collected	1	122,100	109.0	720	122,100	109.0	720	122,100	109.0	720
SJ/SC RWF Influent	3	124,500	111.1	717	125,300	111.8	716	124,100	110.8	717
SVAWPC Influent	13	15,700	14.0	717	20,400	18.2	716	9,400	8.3	717
SVAWPC ROP	16	12,700	11.3	50	16,500	14.7	50	7,600	6.7	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,498	2,900	2.6	4,491	1,300	1.2	4,498
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	77,800	69.5	961	68,400	61.1	1,088	88,800	79.3	774
% RO Concentrate Sent Directly to Outfall	36	9%			13%			2%		
2035, Average Flow, Dry Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	141,600	126.4	718	142,400	127.1	717	141,300	126.1	718
SVAWPC Influent	13	22,400	20.0	718	27,100	24.2	717	16,000	14.3	718
SVAWPC ROP	16	18,100	16.1	50	21,900	19.5	50	12,900	11.5	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.8	4,500	3,900	3.4	4,494	2,300	2.0	4,500
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	76,800	68.6	1,011	67,400	60.1	1,147	87,800	78.4	816
% RO Concentrate Sent Directly to Outfall	36	10%			15%			3%		
2035, Average Flow, Wet Season										
Wastewater Collected	1	138,900	124.0	720	138,900	124.0	720	138,900	124.0	720
SJ/SC RWF Influent	3	141,300	126.1	718	142,100	126.8	717	140,900	125.8	718
SVAWPC Influent	13	15,700	14.0	718	20,500	18.3	717	9,400	8.4	718
SVAWPC ROP	16	12,700	11.3	50	16,500	14.7	50	7,600	6.7	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,500	2,900	2.6	4,494	1,300	1.2	4,500
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	93,000	83.0	921	83,600	74.6	1,021	104,000	92.8	766
% RO Concentrate Sent Directly to Outfall	36	7%			11%			1%		
2035, Maximum Flow, Dry Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	158,400	141.4	718	159,200	142.1	717	158,100	141.1	718
SVAWPC Influent	13	22,400	20.0	718	27,100	24.2	717	16,000	14.3	718
SVAWPC ROP	16	18,100	16.2	50	21,900	19.6	50	12,900	11.6	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	24,000	21.4	500	24,000	21.4	500	24,000	21.4	500
SVAWPC RO Concentrate	15	3,200	2.9	4,502	3,900	3.5	4,497	2,300	2.0	4,502
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	92,000	82.1	963	82,500	73.7	1,069	103,000	91.9	802
% RO Concentrate Sent Directly to Outfall	36	8%			12%			2%		
2035, Maximum Flow, Wet Season										
Wastewater Collected	1	155,700	139.0	720	155,700	139.0	720	155,700	139.0	720
SJ/SC RWF Influent	3	158,100	141.1	718	158,900	141.8	717	157,700	140.8	718
SVAWPC Influent	13	15,700	14.1	718	20,500	18.3	717	9,400	8.4	718
SVAWPC ROP	16	12,700	11.4	50	16,500	14.8	50	7,600	6.8	50
AWPF Influent	18	31,500	28.1	500	43,300	38.7	500	15,700	14.0	500
Total AWPF ROP	22	25,400	22.7	50	35,000	31.2	50	0.0		
Total Potable Re-use	23	25,400	22.7	50	35,000	31.2	50	14,100	12.6	500
% of Potable Re-use Goal Reached	39	73%			100%			40%		
Total Non-Potable Reuse	33	7,500	6.7	500	7,500	6.7	500	7,500	6.7	500
SVAWPC RO Concentrate	15	2,200	2.0	4,502	2,900	2.6	4,497	1,300	1.2	4,502
AWPF RO Concentrate	30	4,500	4.0	3,050	6,200	5.5	3,050	0.0		
Outfall	10	108,200	96.6	893	98,700	88.1	975	119,200	106.4	760
% RO Concentrate Sent Directly to Outfall	36	6%			9%			1%		

Attachment D
Flow Balance Model – Recommended Plan

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Attachment D: Flow Balance Model – Recommended Plan

D.1. Introduction

This attachment presents the flow balance for the near-term and long-term potable reuse recommended plan presented in Section 8.

A flow and mass balance model was created to model the magnitude and TDS of the flows which the SJ/SC RWF, SVAWPC and AWPF(s) would need to produce to reach various future water reuse goals under each phase of build-out, under various scenarios. These scenarios were based on all combinations of wastewater influent, NPR usage and IPR usage, as discussed in Section D.3.

Calculations were performed in Microsoft Excel using flow and mass balance equations. A circular reference with iterative calculations was utilized to determine the equilibrium point of the flows and TDS resulting from ROC from the satellite plant returning to the head of the plant. Note that this model is highly simplified, and its accuracy is limited by the accuracy of the assumptions made (discussed later in this section).

For a summary of results, refer to Table D-4, which lists the maximum production capacities of facilities and resultant TDS for each treatment scenario across all of the considered flow scenarios. Full results are provided in Table D-5.

D.2. Treatment Plant Configuration

The treatment plant configuration used for the flow balance is as illustrated in Figure D-1, along with the flow numbers referenced in the calculations and results tables.

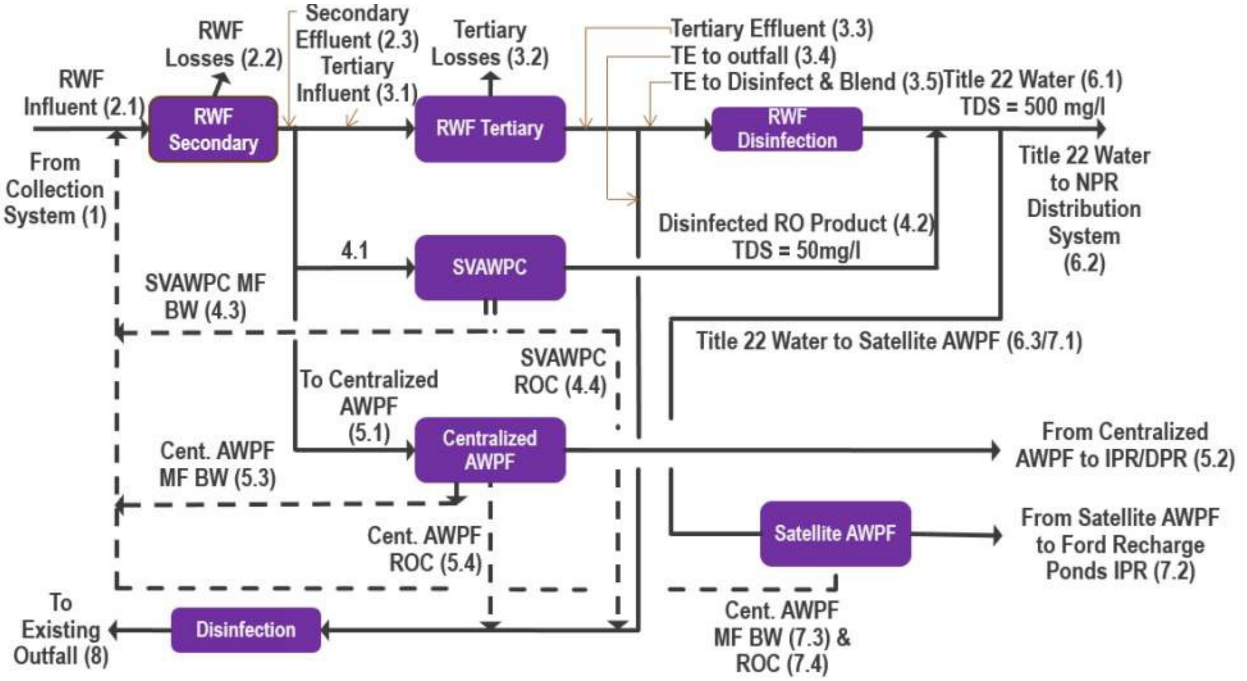

Figure D-1: Flowchart. Note that numbers correspond to the flow numbers which are references in the results tables.

Note that, as ROC from the satellite plant is returned to the sewers, the TDS influent to the RWF, tertiary plant, SVAWPC and centralized AWPF also increases. This increases the TDS of the MF BW and ROC from the SVAWPC and AWPF, as well as the total flow through the SVAWPC necessary to dilute the tertiary effluent down to 500-mg/L. The values reported here are the maximum values returned by the model, after the system reached equilibrium.

D.2.1 Flows Into System

Refer to D.3.1.

D.2.2 Flows Out of System

Water was assumed to leave the system through 6 discharges:

1. Flows from satellite AWPF (refer to D.3.2)
2. Flows from centralized AWPF (refer to D.3.2)
3. NPR (refer to D.3.3)
4. Outfall – Composed of SVAWPC ROC, Centralized AWPF ROC and "unused" tertiary effluent
5. RWF Losses (assumed as 5% of RWF influent)
6. Tertiary Losses (assumed as 5% of Tertiary influent)

D.3. Flow Scenarios

Flow scenarios considered were based on wastewater sent to RWF, IPR and NPR.

D.3.1 Wastewater Sent to RWF

Flows into system were based on data provided by district. Six different flows were considered: minimum, average and maximum anticipated flows for 2025 and 2035. Refer to Table D-1.

Table D-1: Collected Wastewater

Year	Flow	Flow (mgd)
2025	Minimum	105
	Average	115
	Maximum	126
2035	Minimum	109
	Average	124
	Maximum	139

As shown in Figure D-1, these flows were combined with MF BW from the SVAWPC and AWPFs, as well as ROC from the satellite AWPF.

D.3.2 IPR

Potable reuse (indirect or direct) varied based on the phase being considered. Refer to Table D-2. Refer to Section 8 of the SBWR Strategic and Master Plan for more information on the various phases

Table D-2: Potable Reuse Goals

Phase	Description	Total PR Incremental Capacity (AFY)	Total PR Cumulative Capacity (AFY)	Facility Type	Satellite Production Capacity (mgd)	Centralized AWPF Production Capacity (mgd)
0	No IPR	-	-	-	0	0
1	Ford Recharge Ponds IPR	4,200	4,200	Satellite	4.0	0
2	Mid-Basin Injection Wells IPR	5,600	9,800	Central	4.0	5.3
3	Los Gatos Recharge Ponds IPR	20,200	30,000	Central	4.0	24.5
4	Westside Injection Wells IPR or Central Pipeline DPR	5,000	35,000	Central	4.0	29.3

D.3.3 NPR

NPR was based on the District stated goal of 15,000 AFY, and was modeled to vary only based on the season. Seasonal adjustment was accounted for by using an adjustment factor based on the season to determine the NPR flow in MGD necessary to meet the anticipated demand. Refer to Table D-3.

Table D-3: NPR Usage

Season	Adjustment Factor	AFY equivalent	MGD equivalent
Dry	1.6	24,000	21.4
Wet	0.5	7,500	6.7

Larger NPR flows would increase the size of the SVAWPC, and increase TDS to outfall.

D.3.4 Total Scenarios

Based on these inputs, 60 scenarios (permutations of wastewater collected, IPR and NPR) were considered.

$$6 \times 5 h \times 2 = 60$$

D.4. Assumptions Regarding Treatment Processes

The treatment processes were modeled based on the following assumptions.

- Only MF and RO processes were modeled for FAT plants.
- MF processes were assumed to constantly discharge 95% of the plant influent flow as treated water, with five percent to return to the SJ/SC RWF as backwash. In Pathway 1, this backwash would be conveyed through on-site piping; in Pathway 2, the backwash would be conveyed through the sewer.
  - Assuming a larger return rate would decrease the flows through the SVAWPC and AWPFs. This would also slightly increase the TDS through the RWF (as the ROC from the satellite plant would receive less dilution).
- RO processes were assumed to constantly recover 85% of the MF product at 50-mg/l of TDS regardless of influent TDS, with the remaining 15% of the influent flow being discharged as concentrate.
  - Increasing this recovery percentage would:
    - Decrease the flows through the SVAWPC and all AWPFs.
    - Increase the TDS of all ROC
    - Increase the TDS in the outfall
    - Increase the TDS in the RWF

D.5. Conclusions

For a summary of conclusions, refer to Table D-4. For full results, refer to Table D-5.

Table D-4: Summary Results

Phase	Estimated Maximum TDS of RWF Influent (mg/l) [A]	Estimated Phase-to-Phase Increase of RWF Influent TDS	Percent Brine in Outfall[B]	Estimated Maximum TDS of RWF Outfall (mg/l) [B]
Near-Term				
1 (2021)	735	2.1%	2.3%	824
Long-Term				
2 (2025)	735	0%	3.9%	887
3 (2025)	735	0%	12.7%	1,228
4 (2035)	734 [C]	0%	14.8%	1,309

[A]: Based on existing TDS concentration of 720 mg/L.

[B]: Includes brine from the SVAWPC.

[C]: Reduced TDS and brine percentage during phase 4 are due to larger wastewater flows in 2035. Refer to Section D.3.1.

Table D-5: All Results

		Flow		
Flow Desc.	**Flow #**	**mgd**	**AFY equivalent**	**TDS (mg/L)**
Phase 0, 2025 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	105.4	118,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	73.7	83,000	784
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.7%	
Phase 0, 2025 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	115.4	129,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	82.8	93,000	777
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.5%	
Phase 0, 2025 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	126.4	142,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	92.7	104,000	771
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.3%	
Phase 0, 2025 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	105.1	118,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	88.2	99,000	737
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.4%	
Phase 0, 2025 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	115.1	129,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	97.2	109,000	735
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.4%	
Phase 0, 2025 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	126.1	141,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	107.1	120,000	734
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.4%	

Table D-5: All Results

		Flow		
Flow Desc.	**Flow #**	**mgd**	**AFY equivalent**	**TDS (mg/L)**
Phase 0, 2035 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	109.4	123,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	77.3	87,000	781
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.6%	
Phase 0, 2035 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	124.4	139,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	90.9	102,000	772
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.4%	
Phase 0, 2035 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	139.4	156,000	720
SVAWPC ROP	4.2	7.0	8,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	104.4	117,000	765
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		1.2%	
Phase 0, 2035 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	109.1	122,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	91.8	103,000	736
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.4%	
Phase 0, 2035 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	124.1	139,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	105.3	118,000	734
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.4%	
Phase 0, 2035 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	139.1	156,000	720
SVAWPC ROP	4.2	2.2	2,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	0.0	-	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	0.0	-	50
Outfall	8.0	118.9	133,000	732
% ROC in RWF influent	n/a		0.0%	
% ROC in Outfall	n/a		0.3%	

Table D-5: All Results

		Flow		
			AFY	
Flow Desc.	Flow #	mgd	equivalent	TDS (mg/L)
Phase 1, 2025 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	106.5	119,000	735
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	69.8	78,000	824
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		2.3%	
Phase 1, 2025 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	116.5	131,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	78.8	88,000	812
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		2.0%	
Phase 1, 2025 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	127.5	143,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	88.7	99,000	802
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		1.8%	
Phase 1, 2025 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	106.2	119,000	735
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	84.2	94,000	768
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		0.8%	
Phase 1, 2025 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	116.2	130,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	93.2	104,000	763
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		0.8%	
Phase 1, 2025 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	127.2	142,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	103.1	116,000	759
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		0.7%	

Table D-5: All Results

		Flow		
			AFY	
Flow Desc.	Flow #	mgd	equivalent	TDS (mg/L)
Phase 1, 2035 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	110.5	124,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	73.4	82,000	819
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		2.2%	
Phase 1, 2035 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	125.5	141,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	86.9	97,000	803
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		1.8%	
Phase 1, 2035 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	140.5	157,000	731
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	100.4	113,000	792
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		1.6%	
Phase 1, 2035 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	110.2	123,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	87.8	98,000	766
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		0.8%	
Phase 1, 2035 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	125.2	140,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	101.3	114,000	759
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		0.7%	
Phase 1, 2035 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	140.2	157,000	731
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	0.0	-	-
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	4.0	4,000	50
Outfall	8.0	114.9	129,000	755
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		0.6%	

Table D-5: All Results

		Flow		
Flow Desc.	Flow #	mgd	AFY equivalent	TDS (mg/L)
Phase 2, 2025 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	106.8	120,000	735
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	64.7	73,000	887
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		3.9%	
Phase 2, 2025 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	116.8	131,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	73.8	83,000	866
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		3.4%	
Phase 2, 2025 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	127.8	143,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	83.7	94,000	849
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		3.0%	
Phase 2, 2025 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	106.5	119,000	735
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	79.2	89,000	815
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		2.1%	
Phase 2, 2025 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	116.5	131,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	88.2	99,000	806
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		1.9%	
Phase 2, 2025 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	127.5	143,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	98.1	110,000	797
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		1.7%	

Table D-5: All Results

		Flow		
Flow Desc.	Flow #	mgd	AFY equivalent	TDS (mg/L)
Phase 2, 2035 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	110.8	124,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	68.4	77,000	878
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		3.7%	
Phase 2, 2035 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	125.8	141,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	81.9	92,000	852
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		3.1%	
Phase 2, 2035 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	140.8	158,000	731
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	95.4	107,000	833
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		2.6%	
Phase 2, 2035 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	110.5	124,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	82.8	93,000	811
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		2.0%	
Phase 2, 2035 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	125.5	141,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	96.3	108,000	798
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		1.7%	
Phase 2, 2035 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	140.5	157,000	731
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	5.3	6,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	9.3	10,000	50
Outfall	8.0	109.9	123,000	789
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		1.5%	

Table D-5: All Results

Flow Desc.	Flow #	Flow mgd	 AFY equivalent	TDS (mg/L)
Phase 3, 2025 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	108.0	121,000	735
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	46.6	52,000	1,228
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		12.7%	
Phase 3, 2025 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	118.0	132,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	55.6	62,000	1,146
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		10.6%	
Phase 3, 2025 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	129.0	145,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	65.6	73,000	1,081
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		9.0%	
Phase 3, 2025 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	105.0	118,000	720
RWF Influent	2.1	107.7	121,000	735
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	61.1	68,000	1,055
% ROC in RWF influent	n/a		0.7%	
% ROC in Outfall	n/a		8.2%	
Phase 3, 2025 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	115.0	129,000	720
RWF Influent	2.1	117.7	132,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	70.1	79,000	1,012
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		7.2%	
Phase 3, 2025 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	126.0	141,000	720
RWF Influent	2.1	128.7	144,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	80.0	90,000	975
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		6.3%	

Table D-5: All Results

Flow Desc.	Flow #	Flow mgd	 AFY equivalent	TDS (mg/L)
Phase 3, 2035 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	112.0	125,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	50.2	56,000	1,191
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		11.8%	
Phase 3, 2035 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	127.0	142,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	63.8	71,000	1,091
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		9.3%	
Phase 3, 2035 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	142.0	159,000	731
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	77.3	87,000	1,026
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		7.6%	
Phase 3, 2035 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	111.7	125,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	64.7	72,000	1,036
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		7.8%	
Phase 3, 2035 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	126.7	142,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	78.2	88,000	981
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		6.4%	
Phase 3, 2035 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	141.7	159,000	731
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	24.5	27,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	28.5	32,000	50
Outfall	8.0	91.7	103,000	943
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		5.5%	

NOTE: As Phase 4 is not anticipated to be completed until 2035, 2025 results for Phase 4 are omitted here.

Table D-5: All Results

		Flow		
Flow Desc.	Flow #	mgd	AFY equivalent	TDS (mg/L)
Phase 4, 2035 Flows, Dry Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	112.3	126,000	734
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	45.7	51,000	1,309
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		14.8%	
Phase 4, 2035 Flows, Dry Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	127.3	143,000	733
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	59.2	66,000	1,174
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		11.4%	
Phase 4, 2035 Flows, Dry Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	142.3	159,000	731
SVAWPC ROP	4.2	9.0	10,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	21.4	24,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	72.8	82,000	1,090
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		9.3%	
Phase 4, 2035 Flows, Wet Season, Minimum sewer flows				
Wastewater Collected	1.0	109.0	122,000	720
RWF Influent	2.1	112.0	125,000	734
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	60.1	67,000	1,113
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		9.8%	
Phase 4, 2035 Flows, Wet Season, Average sewer flows				
Wastewater Collected	1.0	124.0	139,000	720
RWF Influent	2.1	127.0	142,000	733
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	73.7	83,000	1,041
% ROC in RWF influent	n/a		0.6%	
% ROC in Outfall	n/a		8.0%	
Phase 4, 2035 Flows, Wet Season, Maximum sewer flows				
Wastewater Collected	1.0	139.0	156,000	720
RWF Influent	2.1	142.0	159,000	731
SVAWPC ROP	4.2	4.0	4,000	50
Centralized AWPF ROP	5.2	29.3	33,000	50
Satellite AWPF ROP	7.2	4.0	4,000	50
NPR	6.2	6.7	8,000	500
Total IPR/DPR	5.2+7.2	33.3	37,000	50
Outfall	8.0	87.2	98,000	991
% ROC in RWF influent	n/a		0.5%	
% ROC in Outfall	n/a		6.7%	

Attachment E
Meeting Minutes – EBDA

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South Bay Water Recycling
Strategic and Master Planning

Draft Meeting Notes

Subject:	**SBWR Regional Concentrate Management**
Prepared by:	**Andria Loutsch, CDM Smith**
Date/Time:	**Wednesday, September 25, 2013**
Location:	**EBDA, 2651 Grant Avenue, San Lorenzo**
Attendees:	**Mike Connor, EBDA** **Hossein Ashktorab, SCVWD** **Marilyn Bailey, RMC** **Andria Loutsch, CDM Smith** **Ed Fernbach, CDM Smith**
Reference:	**Subtask 2.4.3 Regional Concentrate Management Assessment**

Purpose of Meeting

The objectives of the meeting were to:

- Understand whether there are opportunities for South Bay Water Recycling (SBWR) to partner with East Bay Dischargers Authority (EBDA) for regional concentrate management.
- Determine technical/regulatory/institutional issues that would need to be addressed.

Discussion Summary

1. **Possible connection points to EBDA system**

Option 1: Connect pipeline for SBWR's reverse osmosis (RO) concentrate to Union Sanitary District (USD)'s raw sewage pump station (PS) in Newark for treatment through USD's wastewater treatment plant. This would require an agreement between USD and the City and/or District. SBWR would likely be treated as an industrial discharger, potentially with additional costs and salinity limits. An 18-inch to 24-inch diameter pipeline from the San Jose/Santa Clara Regional Wastewater Facility (RWF) to USD's Newark PS would be approximately 12 miles.

However, USD would be unable to accommodate the additional flow within its capacity constraints with the EBDA system during peak wet weather events. There are periods during 15-20 days per year when they reach effluent conveyance capacity. USD's average flow is 24 million gallons per day (mgd) and their allowed peak daily wet weather flow discharge into the EBDA outfall is 42.9 mgd. Their permitted average dry weather flow is 38 mgd, and they have about 12 mgd of capacity available. In peak wet weather periods, USD may reach 90 mgd. An SBWR RO facility may need storage for one to two days to wait for high winter storm flows to pass before discharging to USD's influent system. Another option is to turn off the RO plant during those periods, since the SBWR plant would be used for indirect potable reuse, which is not a base loaded use.

Option 2: Connect RO concentrate pipeline to EBDA's Alvarado effluent PS in Union City, approximately 19 miles from the RWF. This would require an agreement with EBDA for capacity in their system. The most constrained portion of EBDA's system is the Alvarado PS and the pipeline capacity to Hayward, where the capacity is limited by the pipe size during peak wet weather flows. When there are capacity issues at Alvarado PS, EBDA stores the treated Hayward wastewater in the Hayward ponds.

EBDA does have capacity in its dechlorination facility and outfall. The outfall capacity is 190 mgd (180 mgd at high tide). There are only 10-20 hours per year when EBDA's flow is above 150 mgd; EBDA's average flow is 75 mgd.

The SBWR connection would probably be treated like a direct connection, similar to EBDA's agreement with Livermore-Amador Valley Water Management Agency (LAVWMA). LAVWMA is charged for capital costs for repair and replacement, variable costs for chemicals and power based on flow, and pollutant loading.

Some of the treated wastewater flow from the Alvarado PS goes to the East Bay Regional Parks Hayward Marsh. This discharge to the marsh can be dechlorinated but this capability is rarely needed as the chlorine residual in the EBDA pipelines is very low. The RO concentrate could be a concern if it has high ammonia levels (see #2 below).

2. **Water quality issues**

EBDA is not concerned about the potential salinity of SBWR's brine, but with the concentration of constituents such as copper and ammonia. Toxicity testing would be necessary before allowing the RO concentrate into the EBDA system. All toxicity testing for NPDES compliance is done at the EBDA Marina Dechlorination Facility. EBDA gets a 10:1 dilution credit for calculating the effluent limits for non-bioaccumulating toxics like copper.

Each agency in the EBDA system is required to meet the total suspended solids and biological oxygen demand standards and their technology based limits for secondary effluent. All agencies have to do chlorine residual and fecal coliform testing.

3. **Future of EBDA system**

EBDA's flows have decreased about 10 mgd over the last 10-15 years compared to historical flows. EBDA's outfall has approximately 40 more years of useful life. EBDA would like to move away from discharging directly into the Bay to discharging through the series of marshes along the East Bay. The Hayward Area Shoreline Planning Agency views marsh restoration as protection against sea level rise and storm surge. EBDA will need to spend $200 to $300 million in the next 20-30 years to replace its large conveyance lines, which would be more expensive than if EBDA moved to shoreline marsh discharge along the conveyance system.

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Attachment F
Meeting Minutes – SBSA

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South Bay Water Recycling
Strategic and Master Planning

Draft Meeting Notes

Subject:	**SBWR Regional Concentrate Management**
Prepared by:	**Andria Loutsch, CDM Smith**
Date/Time:	**Wednesday, September 25, 2013**
Location:	**SVCW, Fishbowl Conference Room, 1400 Radio Road, Redwood City**
Attendees:	**Teresa Herrera, SVCW** **Monte Hamamoto, SVCW** **Kim Hackett, SVCW** **Marilyn Bailey, RMC** **Andria Loutsch, CDM Smith** **Ed Fernbach, CDM Smith**
Reference:	**Subtask 2.4.3 Regional Concentrate Management Assessment**

Purpose of Meeting

The objectives of the meeting were to:

- Understand whether there are opportunities for South Bay Water Recycling (SBWR) to partner with the Silicon Valley Clean Water (SVCW) (formerly known as South Bayside System Authority, name changed in February 2014) for regional concentrate management.
- Determine technical/regulatory/institutional issues that would need to be addressed.

Discussion Summary

1. **Possible connection points to SVCW system**

The SVCW collection system does not have excess capacity to take reverse osmosis (RO) concentrate flows from an SBWR RO facility. The SVCW wastewater treatment plant (WWTP) uses an equalization basin on peak wet weather days at the Menlo Park pump station because of capacity and reliability issues. The influent conveyance system that includes a single pipeline and three pump stations along Highway 101 between Menlo Park and Belmont is in the process of being upgraded and replaced.

A pipeline would need to be constructed to bring the brine to the SVCW outfall in Redwood City, approximately 24 miles from the San Jose/Santa Clara Regional Wastewater Facility. SVCW has a deep water outfall with a maximum capacity of 160 mgd, twice the wet weather capacity of WWTP. SVCW also supplies effluent for recycled water within Redwood City and Redwood Shores.

The brine line could connect at the backend of the WWTP after the effluent pumps. If the concentrate connection was before SVCW's National Pollutant Discharge Elimination System (NPDES) permit compliance point, the concentrate would be treated as an industrial discharger to the SVCW system. If the connection was after SVCW's compliance point, the concentrate discharge would need its own NPDES permit and then pay SVCW for outfall capacity.

2. **Water quality issues**

   Sodium is the largest problem for SVCW influent water quality. SVCW requires customers to limit their sodium discharge to 7,000 pounds per day due to potential impacts to the WWTP's biological processes. There are also concerns that high influent sodium levels could affect recycled water quality. SVCW has to maintain a TDS level of 700 mg/L to meet Redwood City's recycled water quality requirements. The potential 6-mgd SVCW brine flow would be three to four times SVCW's allowable salinity.

   SVCW's effluent is under its constituent limits for its NPDES permit, and has not experienced toxicity issues.

Appendix 7A - Phase 1 Injection TM

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TODD ENGINEERS

GROUNDWATER • WATER RESOURCES • HYDROGEOLOGY • ENVIRONMENTAL ENGINEERING

TECHNICAL MEMORANDUM

Date September 11, 2013

To: Tom Richardson, RMC
Jennifer Thompson, CDM Smith

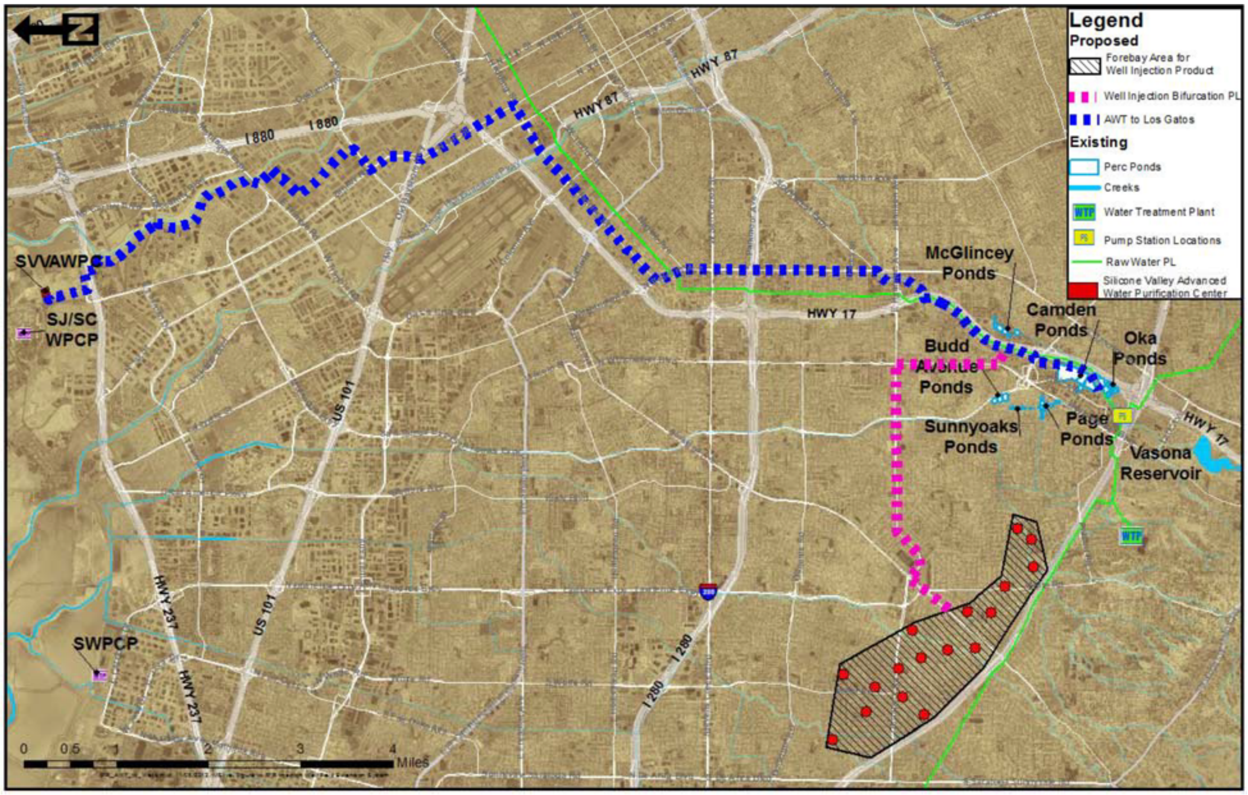
From: Sally McCraven, Todd Engineers
Daniel Craig, Todd Engineers

Re: Hydrogeologic Evaluation of Phase 1 Injection of Advanced Treated Recycled Water - South Bay Water Recycling Project

INTRODUCTION

RMC Water and Environment (RMC) requested that Todd Engineers (Todd) evaluate the preliminary feasibility of a Phase 1 potable reuse project involving injection of advanced water treatment (AWT) recycled water in the Santa Clara Sub-Basin. The Phase 1 project would utilize AWT recycled water produced at the Silicon Valley Advanced Water Purification Center (SVAWPC). Ideally, the injection well or wells would be located as near as possible to the SVAWPC to minimize piping and pumping costs. The analysis assumes that 2,000 acre-feet per year (AFY) of AWT recycled water would be injected and retained underground for a minimum of three months prior to recovery at any production well, as required to meet the California Department of Public Health (CDPH) pathogen control and response time requirements for recycled water recharge projects (CDPH, June 2013). Injection well(s) would be located near the proposed AWT pipeline to the Los Gatos recharge ponds and as near to the SVAWPC as possible, while allowing recovery by production wells. The locations of the SVAWPC and AWT

Figure 1 – Pathway 1 – Groundwater Recharge with Centralized Treatment



Locating injection well(s) very near to the SVAWPC is limited by the currently high (above the ground surface) potentiometric surface and the lack of nearby active production wells to recover the recharged water. Accordingly, under current conditions, injected AWT recycled water very near the SVAWPC would ultimately discharge to San Francisco Bay without recovery

This memo presents a preliminary evaluation of the feasibility of utilizing injection well(s) for recharge of AWT recycled water at locations near the AWT pipeline and nearer to the SVAWPC than the proposed well locations west of the Los Gatos recharge ponds. Todd assessed aquifer recharge potential via injection at two locations: 1) one relatively closer to the SVAWPC, and 2) the other, farther south along the AWT pipeline, where available aquifer storage capacity is slightly greater. The first injection location is referred to as the North San Jose Injection System, while the second is referred to as the South San Jose Injection System. The analyses included assessment of hydrogeologic conditions beneath and near the potential injection

Injection Site Identification

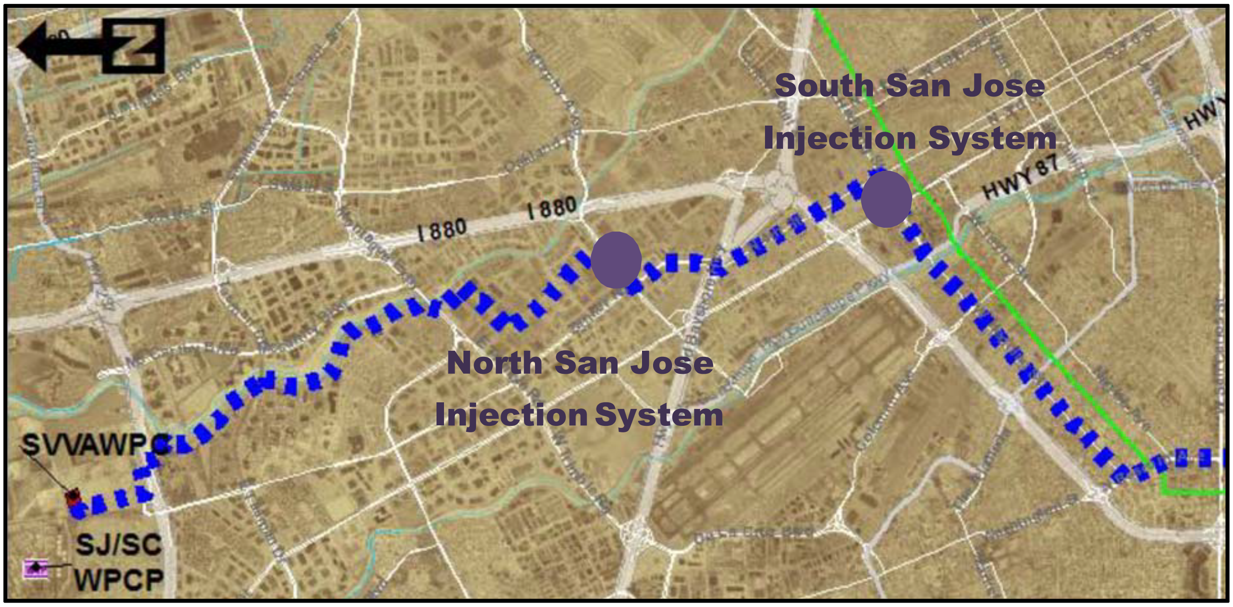
Although numerous parameters and criteria are potentially relevant to the siting and optimizing an injection well system, the criteria selected for preliminary screening of injection well sites included 1) proximity to the SVAWPC and proposed AWT pipeline alignment, 2) currently available or potentially available future aquifer storage capacity, 3) location of existing active or inactive supply wells that could re-capture injected water, 4) existing or potential groundwater production, and 5) location of injection wells such that CDPH retention time requirements are

Through discussions with the cities of San Jose and Santa Clara, RMC has determined that water purveyors including the City of San Jose, City of Santa Clara, and possibly the San Jose Water Company (SJWC) might be interested in pumping wells that are currently inactive or installing new extraction wells, thus lowering the potentiometric surface and increasing available storage capacity. For this assessment, it was assumed that existing inactive wells owned by San Jose, Santa Clara, or SJWC could be operated to increase aquifer storage capacity and capture some

Figure 2 shows the location of the North and South San Jose Injection Systems. The North San Jose Injection System is located near the Montague Expressway, east of Highway 880 and north of Highway 101.

The South San Jose Injection System is located near the AWT pipeline east of Highway 880/17 and south of Highway 101.

Figure 2 – Locations of North and South San Jose Injection Well Sites


N
South San Jose Injection System
HWY
HWY 87
I 880
I 880
North San Jose Injection System
SVAWPC
SJ/SC WPCP

Hydrogeologic Characteristics of Proposed Injection Sites

Hydrogeologic characteristics of the proposed sites (depth-to-water, groundwater flow directions relative to extraction wells, aquifer hydraulic conductivity, well yields, and recent production) were evaluated to estimate aquifer storage capacity, injection well injection rates,

Aquifers beneath the North and South San Jose Injection System areas are comprised of a shallow aquifer, a continuous regional Bay Mud aquitard, and a deeper confined aquifer, referred to as the Principal Aquifer. Most active production wells produce groundwater from the Principal Aquifer, and are completed to depths typically between 300 to 700 feet below ground surface (ft-bgs). In these areas of the Santa Clara Sub-Basin, the Principal Aquifer is fully confined by the regional aquitard (DWR, 1975). The aquifer system is unconfined and recharge areas exist along the edges of the groundwater sub-basin to the south and northeast of the proposed injection sites. **Figures 3**[1] and **4** show groundwater elevation contours in the Principal

Based on Spring and Fall 2012 groundwater elevation contour maps prepared by the District and the estimated ground surface elevation, the range of depths to water in the Principal Aquifer at the northern injection site is from 3 and 12 feet above the ground surface (ft-ags) and the range in depths to water at the southern injection site is from 0 and 15 ft-bgs. Accordingly, there is limited currently available aquifer storage capacity at either location and increased groundwater extraction near the sites would be needed to create drawdown and

Figures 3 and **4** also show the locations of San Jose, Santa Clara and SJWC wells as wells as other active and inactive production wells near the proposed injection well sites. As shown in the figures, there are four City of San Jose water supply wells located north of the proposed North San Jose Injection System. There are no production wells located in the immediate

---

[1] The Spring 2012 contour map shows a groundwater depression around two City of San Jose wells located northwest of the proposed northern injection well site, yet the average annual pumping shows no pumping in this Township/Section (see Figure 5). This discrepancy in the data needs to be resolved with the District

Figure 3 – Groundwater Elevation Contour Map in Principal Aquifer Spring 2012

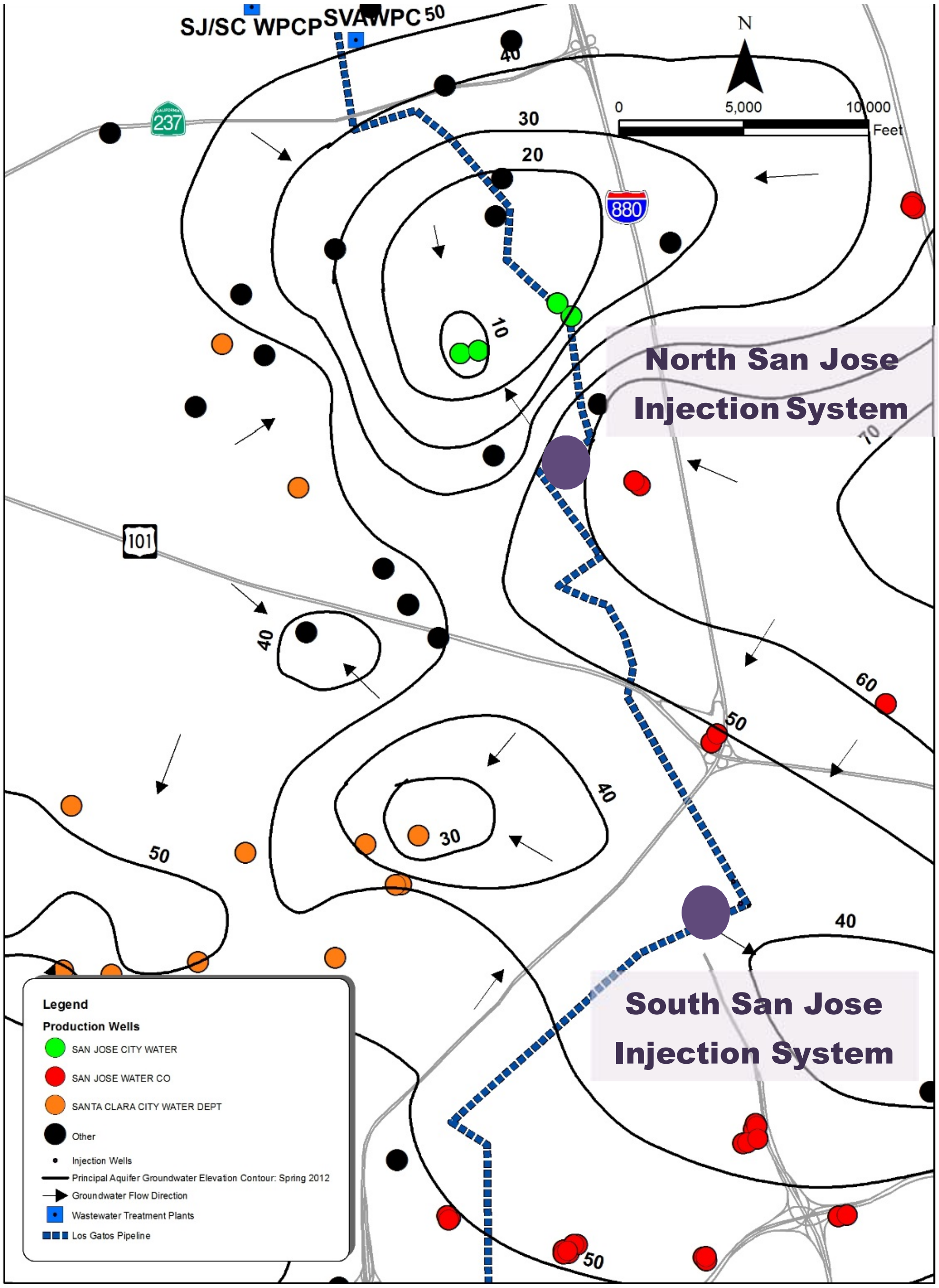


Figure 4 – Groundwater Elevation Contour Map in Principal Aquifer Fall 2012

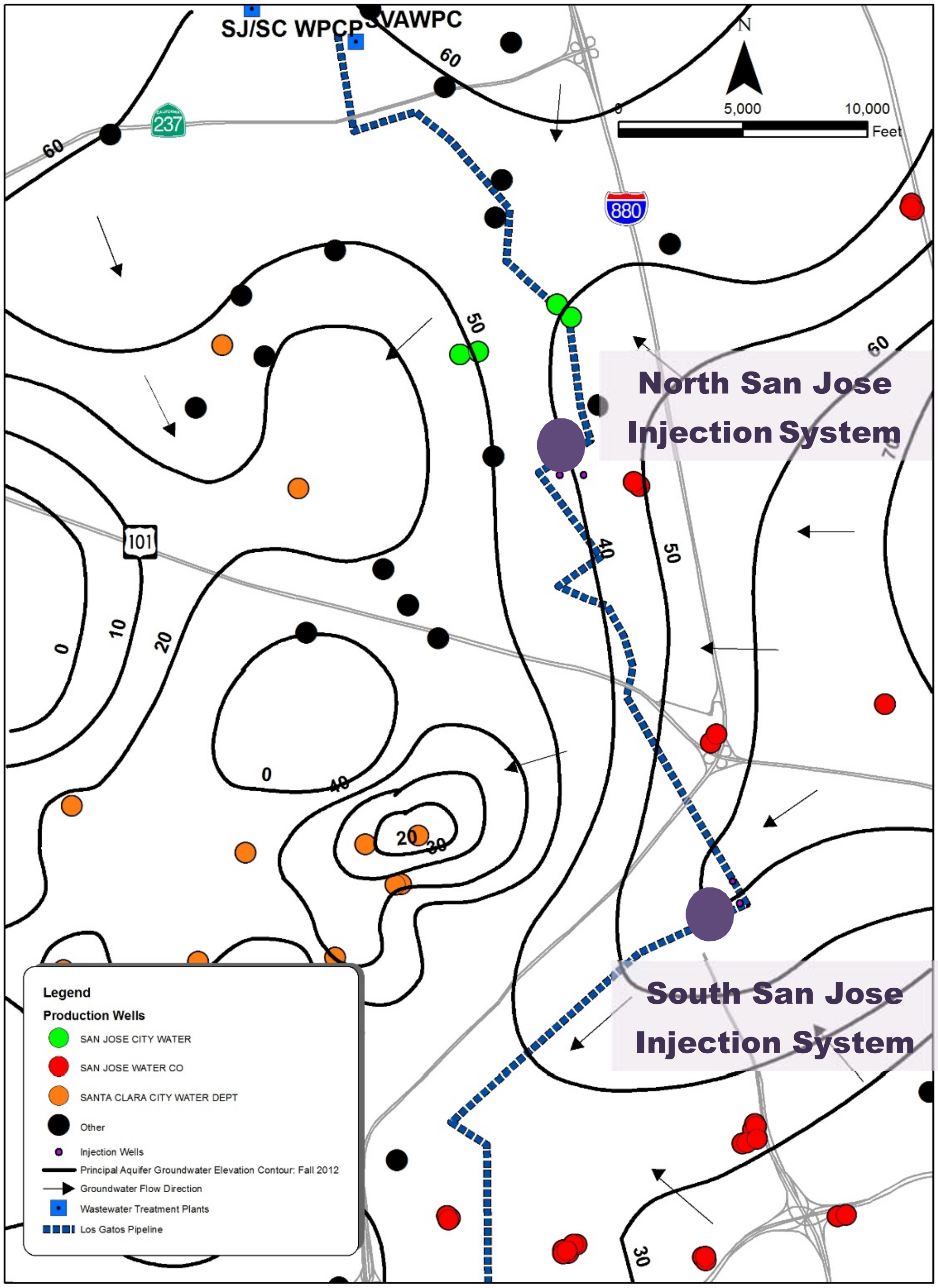

SJ/SC WPCP
SVAWPC
N
0
5,000
10,000
Feet
237
880
101
60
60
60
50
50
40
40
30
30
20
20
10
0
0
70
North San Jose Injection System
South San Jose Injection System
Legend
Production Wells
SAN JOSE CITY WATER
SAN JOSE WATER CO
SANTA CLARA CITY WATER DEPT
Other
Injection Wells
Principal Aquifer Groundwater Elevation Contour: Fall 2012
Groundwater Flow Direction
Wastewater Treatment Plants
Los Gatos Pipeline

Figure 5 shows the average annual groundwater production within each Township/Section between 2008 and 2012. **Figure 5** also shows all production wells (both active and inactive) in addition to those owned by San Jose, Santa Clara, and the SJWC. The figure indicates that there is limited groundwater production along the northern AWT pipeline or in the immediate vicinity of the proposed injection wells sites and that the four City of San Jose wells located north of the northern injection well site are inactive. There is significant groundwater extraction (>1,200

Number of Injection Wells and Spacing

The current target potable flow rate for the Phase 1 groundwater injection project is 2,000 AFY or approximately 1.8 million gallons per day (mgd) or 1,200 gallons per minute (gpm). Although significant local variations in aquifer properties and well yields are reported in the Santa Clara Sub-Basin, local existing production wells generally are capable of reliably yielding around 500 gpm, with locally higher exceptions. Injection wells typically achieve slightly lower flow rates compared with extraction wells and require increased down time for maintenance. Therefore, the assumed average injection rate of each injection well is estimated to be 400 gpm (0.6 mgd).

Retention Time Calculation

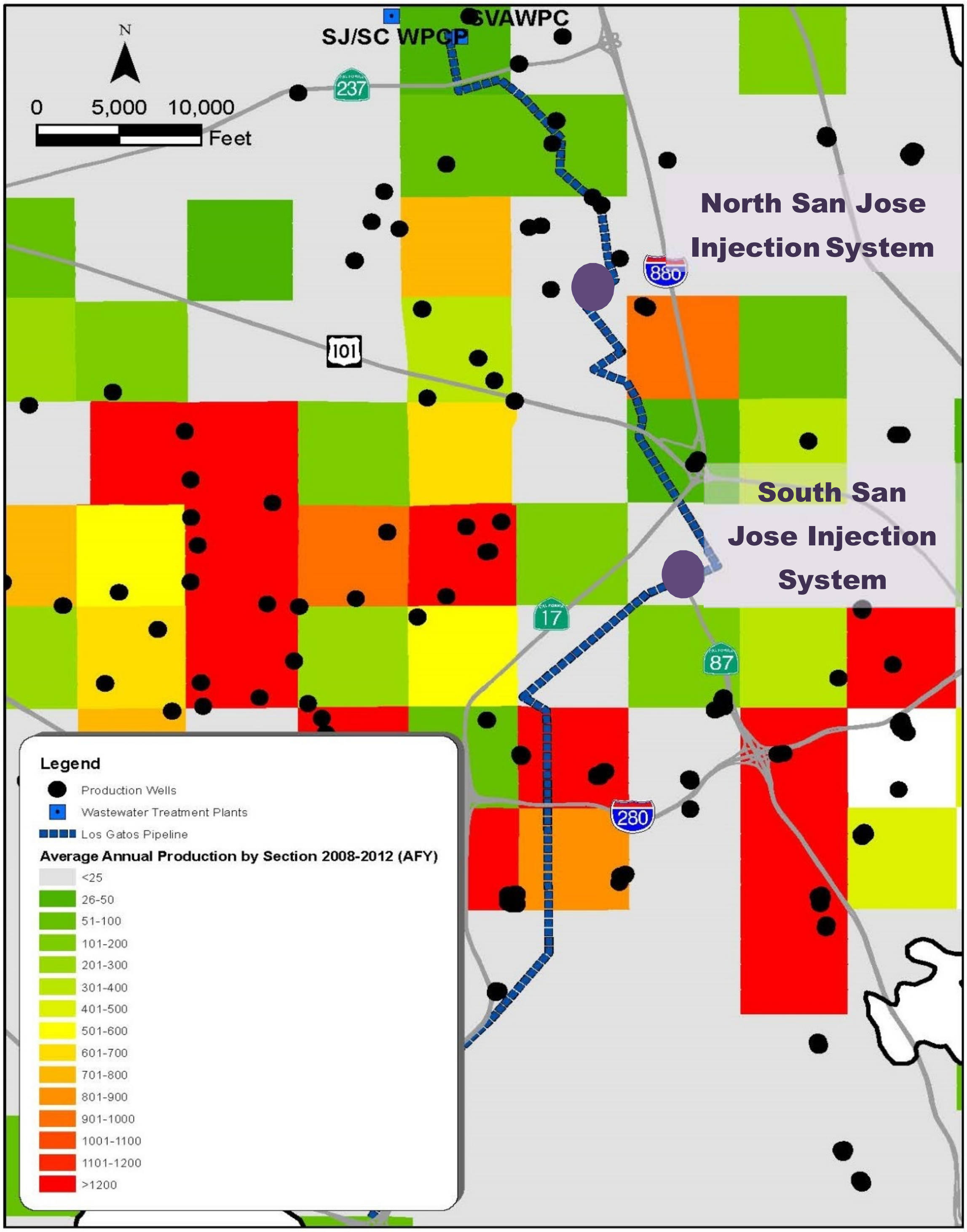
The Darcy's law equation was used to estimate groundwater velocities and retention zones around the proposed injection well sites to determine if any existing production wells would potentially be within the required retention time zone. A three month retention time is assumed. Darcy's law is the basic equation that describes fluid flow through porous media

$$v = -K(\Delta h/\Delta l)/n$$

where v = average linear velocity in feet per day, , K = hydraulic conductivity in feet per day, $\Delta h/\Delta l$ = hydraulic gradient in foot/foot (h = head and l = distance), and n = effective porosity in percent

Because of uncertainties associated with the Darcy equation parameters, CDPH requires application of a safety factor of four to the retention time estimate. The Spring and Fall 2012 groundwater elevation contour maps were used to estimate hydraulic gradients. **Figures 6** and **7** show the Spring 2012 and Fall 2012 groundwater elevation contours, respectively, and general flow directions in the Principal Aquifer (District, undated) near the two injection well sites, along with average annual groundwater production by Township/Section between 2008

Figure 5 – Average Annual Production by Township/Section



The hydraulic conductivity used in the calculations was based on previously evaluated and validated data obtained from constant-rate pumping and recovery tests (CH2M Hill, 1992). Constant rate pumping tests in the area indicate a representative hydraulic conductivity of 30 feet per day (ft/day). An effective porosity of 0.15 was assumed. The calculated retention time

Table 1 – Retention Time Calculations

	K (ft/day)	Δh/Δl (ft/ft)	n (%)	Velocity (ft/day)	3-Month Retention Distance (ft)	12-Month Retention Distance (ft) [a]
Northern Site (Spring 2012 gradient)	30	0.009	0.15	1.8	164	657
Northern Site (Fall 2012 gradient)	30	0.0028	0.15	0.56	51	204
Southern Site (Spring 2012 gradient)	30	0.001	0.15	0.2	18	73
Southern Site (Fall 2012 gradient)	30	0.003	0.15	0.6	55	219

ft/day – feet per day
ft/ft – foot per foot
a – times 4 safety factor

The retention time areas around the injection wells are shown in **Figures 6** and **7** for the Spring and Fall 2012 hydraulic gradients, respectively. There are no production wells within the 12-month (3-month retention time corrected for x 4 safety factor) retention distance

Note that injection of AWT recycled water will produce a groundwater mound and increase the local hydraulic gradients and associated velocities at the injection sites. To assess potential performance and impacts of the conceptual injection system on nearby wells, a local scale numerical groundwater flow model could be constructed to simulate system performance and

Figure 6 – Spring 2012 Groundwater Elevation Contours in Principal Aquifer and Calculated Retention Times

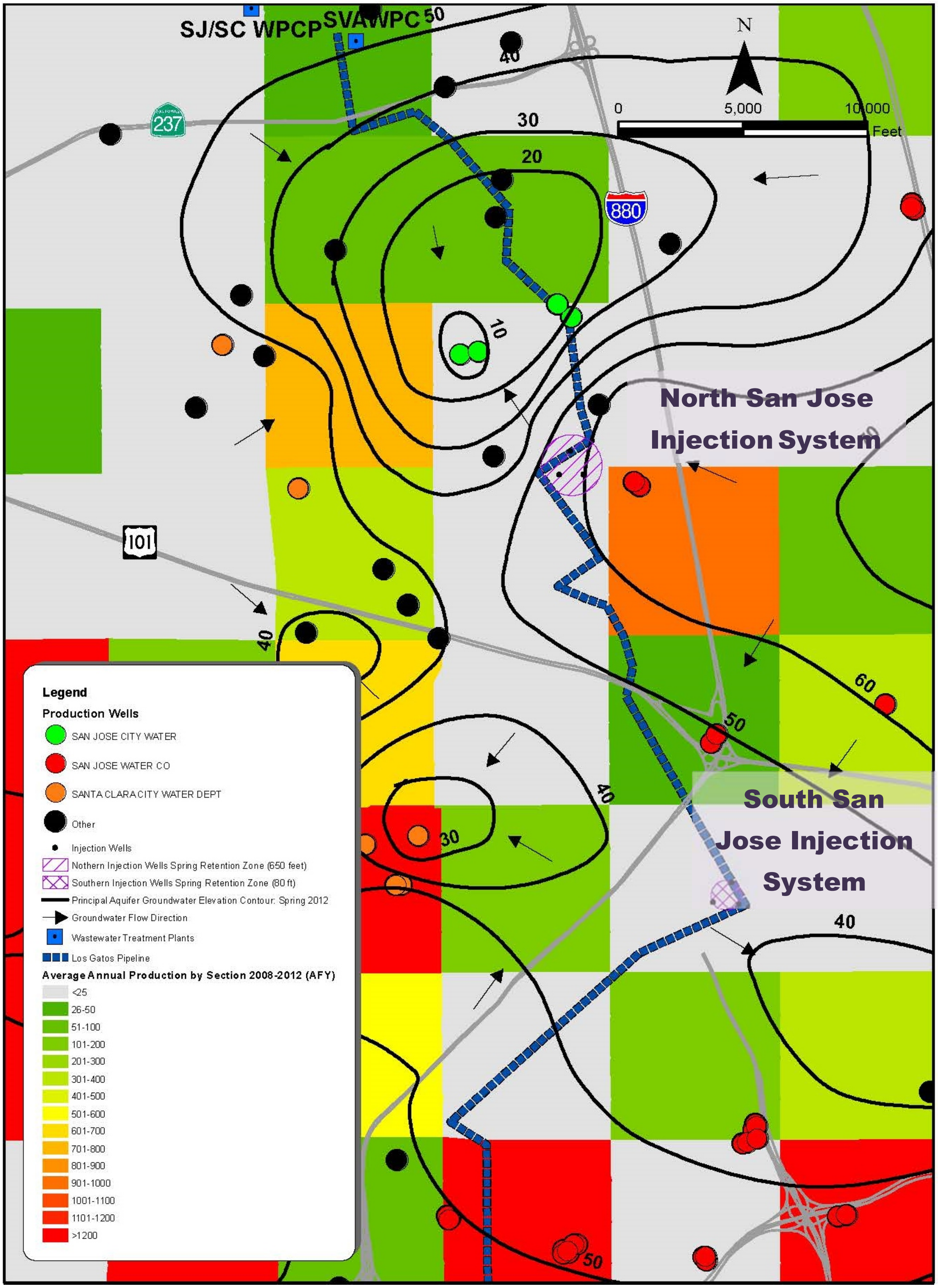
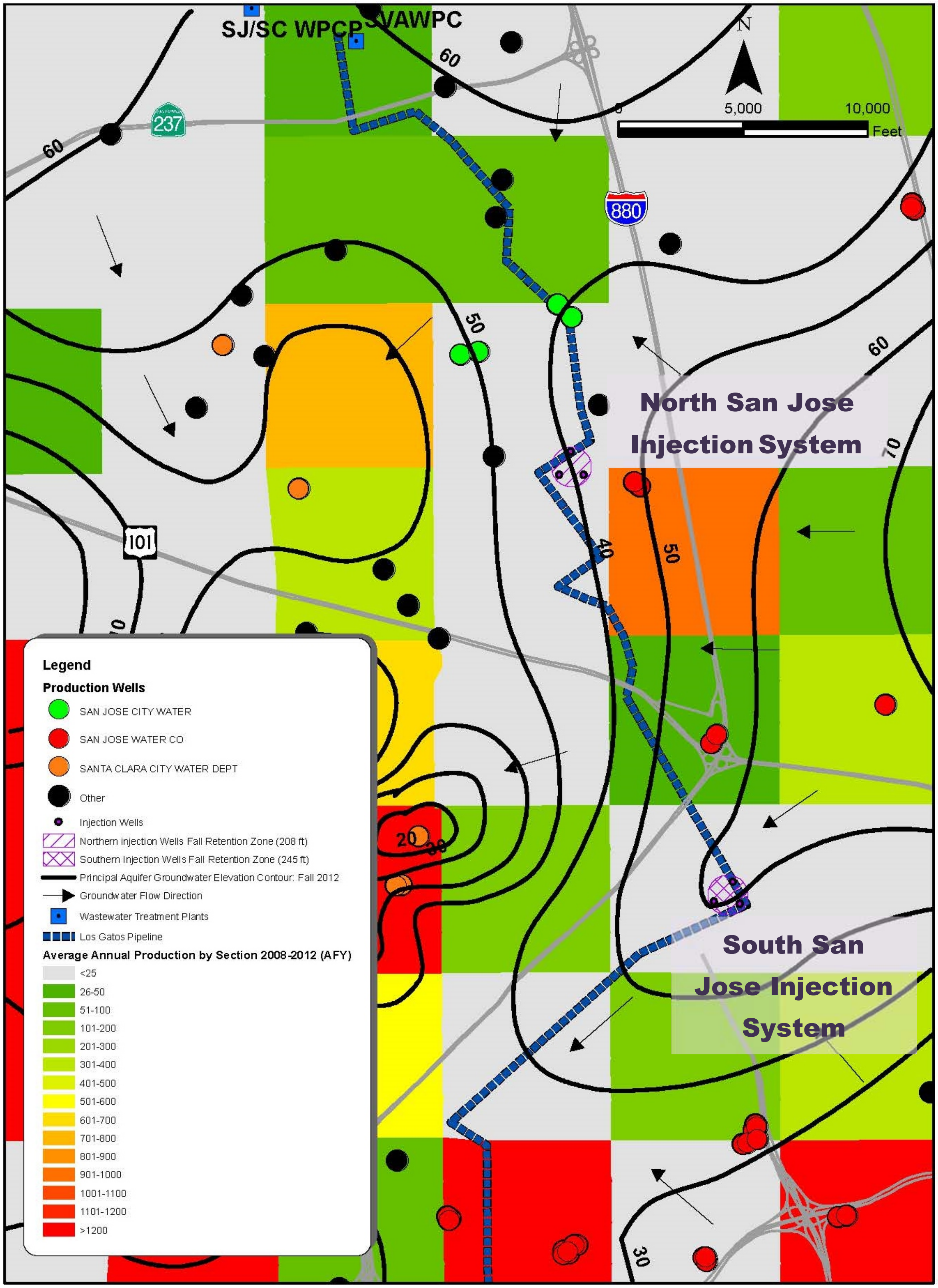

SJ/SC WPCP
SVAWPC
50
40
30
20
10
N
0
5,000
10,000
Feet
237
880
101
North San Jose Injection System
South San Jose Injection System
40
60
50
40
30
40
50
Legend
Production Wells
SAN JOSE CITY WATER
SAN JOSE WATER CO
SANTA CLARA CITY WATER DEPT
Other
Injection Wells
Nothern Injection Wells Spring Retention Zone (650 feet)
Southern Injection Wells Spring Retention Zone (80 ft)
Principal Aquifer Groundwater Elevation Contour: Spring 2012
Groundwater Flow Direction
Wastewater Treatment Plants
Los Gatos Pipeline
Average Annual Production by Section 2008-2012 (AFY)
<25
26-50
51-100
101-200
201-300
301-400
401-500
501-600
601-700
701-800
801-900
901-1000
1001-1100
1101-1200
>1200

Figure 7 – Fall 2012 Groundwater Elevation Contours in Principal Aquifer and Calculated Retention Zone


SJ/SC WPCP
SVAWPC
60
60
237
880
101
N
0
5,000
10,000
Feet
50
60
70
40
50
20
30
30
North San Jose Injection System
South San Jose Injection System
Legend
Production Wells
SAN JOSE CITY WATER
SAN JOSE WATER CO
SANTA CLARA CITY WATER DEPT
Other
Injection Wells
Northern injection Wells Fall Retention Zone (208 ft)
Southern Injection Wells Fall Retention Zone (245 ft)
Principal Aquifer Groundwater Elevation Contour: Fall 2012
Groundwater Flow Direction
Wastewater Treatment Plants
Los Gatos Pipeline
Average Annual Production by Section 2008-2012 (AFY)
<25
26-50
51-100
101-200
201-300
301-400
401-500
501-600
601-700
701-800
801-900
901-1000
1001-1100
1101-1200
>1200

Conclusions

There is limited existing available storage capacity near the proposed injection wells sites. Water injected into a confined aquifer is stored as increased pore pressure. As a result, there is a maximum additional pressure that a formation can tolerate before excess pressure begins to fracture the confining sediments and the injected water moves into the overlying confining layer. Accordingly, in order for a Phase 1 AWT injection project to be feasible along the northern portion of the AWT pipeline to the Los Gatos recharge ponds, existing City of San Jose production wells near the northern proposed site would need to be pumped to reduce groundwater levels and increase available storage capacity. At the southern proposed site, there are no nearby existing production wells and new extraction wells would need to be

References

California Department of Public Health (CDPH), June 26, 2013. Groundwater Replenishment with Recycled Water.

CH2M Hill, 1992. Santa Clara Valley Groundwater Model Project; Hydraulic Analysis of

DWR, 1975. Bulletin 118-1, Evaluation of Groundwater Resources of the South Bay, Vol. I & II.

Santa Clara Valley Water District (District) undated. Annual Groundwater Report for Calendar Year 2012.

Appendix 7B - Ford Pond Indirect Potable Reuse Project Preliminary Hydrogeologic and Regulatory Evaluation

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South Bay Water Recycling
Strategic and Master Planning

Technical Memorandum

Title:	**Ford Pond Indirect Potable Reuse Project Preliminary Hydrogeologic and Regulatory Evaluation**
Version:	**Administrative Draft**
Prepared by:	**Dan Craig, Todd Groundwater** **Sally McCraven, Todd Groundwater**
Reviewed by:	**Bruce Chalmers, CDM Smith** **Tom Richardson, RMC**
Date:	**December 15, 2014**
Reference:	**Task 3.1.1 Ford Pond Project IPR Study**

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1. Introduction

1.1 TM Purpose

The purpose of this Ford Pond Groundwater Replenishment Recharge (Ford Pond GWR) Indirect Potable Reuse (IPR) Study is to provide a preliminary regulatory and hydrogeologic analysis of the feasibility of the concept of recharging 4,200 acre-feet per year (AFY) or about 4 million gallons per day (mgd) of purified recycled water in the Ford Pond area. This technical memorandum (TM) was developed as part of the Strategic and Master Planning Report (Strategic Plan), which was prepared by the City of San José (San José) in partnership with the Santa Clara Valley Water District (SCVWD or District), to evaluate how

1.2 TM Background

The concept explored in this TM is an IPR project that would include a 4 million gallon per day (mgd) satellite advanced water purification facility (AWPF) located near the south end of the South Bay Water Recycling (SBWR) system that would produce purified recycled water that could be recharged to the Santa Clara Subbasin through surface spreading in newly constructed/expanded percolation ponds in the vicinity of the existing Ford Pond. The Ford Pond has historically been used by the District for recharge of stormwater and imported water. Advanced treatment including microfiltration, reverse osmosis, and advanced oxidation process (MF/RO/AOP) would be provided to ease regulatory

1.3 TM Organization

This TM is organized as follows:

1. Introduction
2. Project Concept
3. Preliminary Hydrogeologic and Regulatory Evaluation

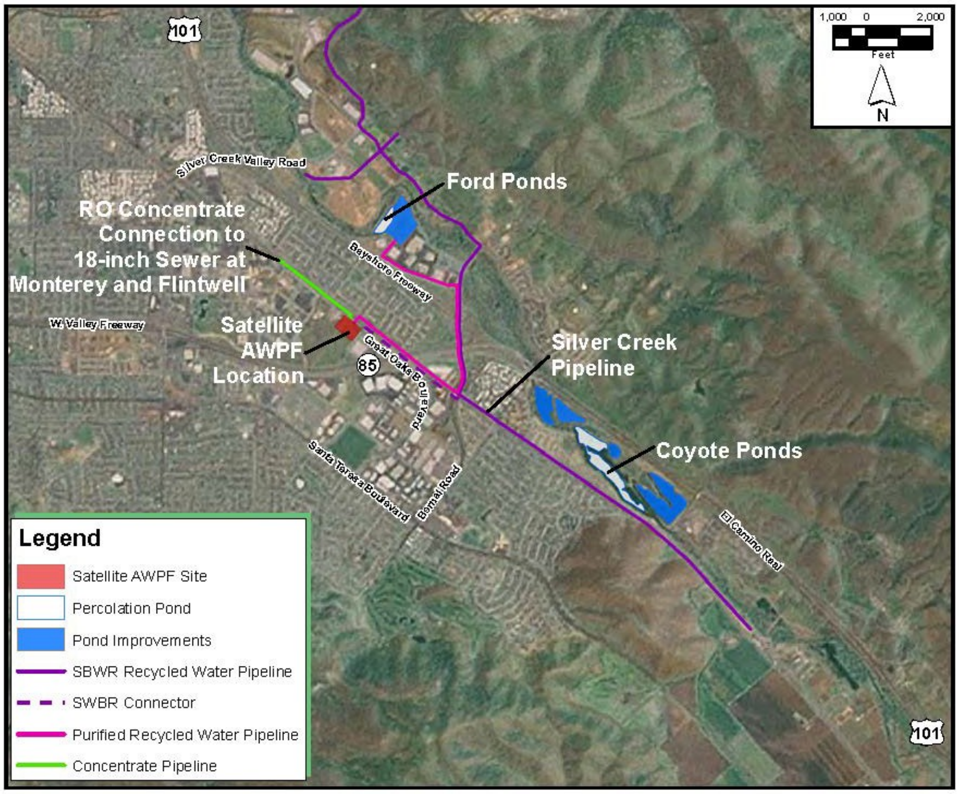
2. Project Concept

The Ford Pond groundwater recharge (GWR) project was identified as part of the SBWR Strategic and Master Planning as a potential near-term potable reuse project. The initial planning for the project is for 4,200 AFY of groundwater recharge based on treating a minimum of 4 mgd of SBWR recycled water with MF, RO, and AOP. If preliminary calculations demonstrate the project is feasible, the ultimate capacity of the Ford Pond GWR project and its ability to meet regulatory requirements would be confirmed by groundwater modeling. This project would be located north of Coyote Valley area in the Santa Clara

The near-term Ford Pond project would involve the construction of a satellite AWPF in the area of the Ford Pond, and treating SBWR recycled water with full advanced treatment before recharge at an expanded off-stream Ford Pond. It is assumed that the AWPF would be located on vacant land on Great Oaks Boulevard. Based on an estimated AWPF recovery rate of 80 percent (MF recovery of 94 percent and RO recovery of 85 percent) and AWPF annual online factor (94 percent), the potential yield for this option would be approximately 4,200 AFY. The MF backwash waste and RO concentrate would be [illegible]

The project elements are shown in Figure 2-1.

Figure 2-1: Ford Pond GWR Project



The near-term Ford Pond project includes the following major facilities:

- A satellite AWPF with 4-mgd production capacity
- Source water pipeline
- Product water pipeline

The near-term Ford Pond GWR project is discussed in detail in the Strategic and Master Planning Report. The sites for the AWPF and for the percolation ponds are conceptual and the actual sites would be determined in future siting evaluations

The City of Santa Clara relies on groundwater for 60 percent of their water supply and has an extensive network of groundwater production wells. Other nearby water purveyors include the City of San Jose and San Jose Water Company. The recycled water recharge would potentially benefit all water purveyors in the north Santa Clara County area (i.e., Santa Clara Subbasin).

3. Preliminary Hydrogeologic and Regulatory Evaluation

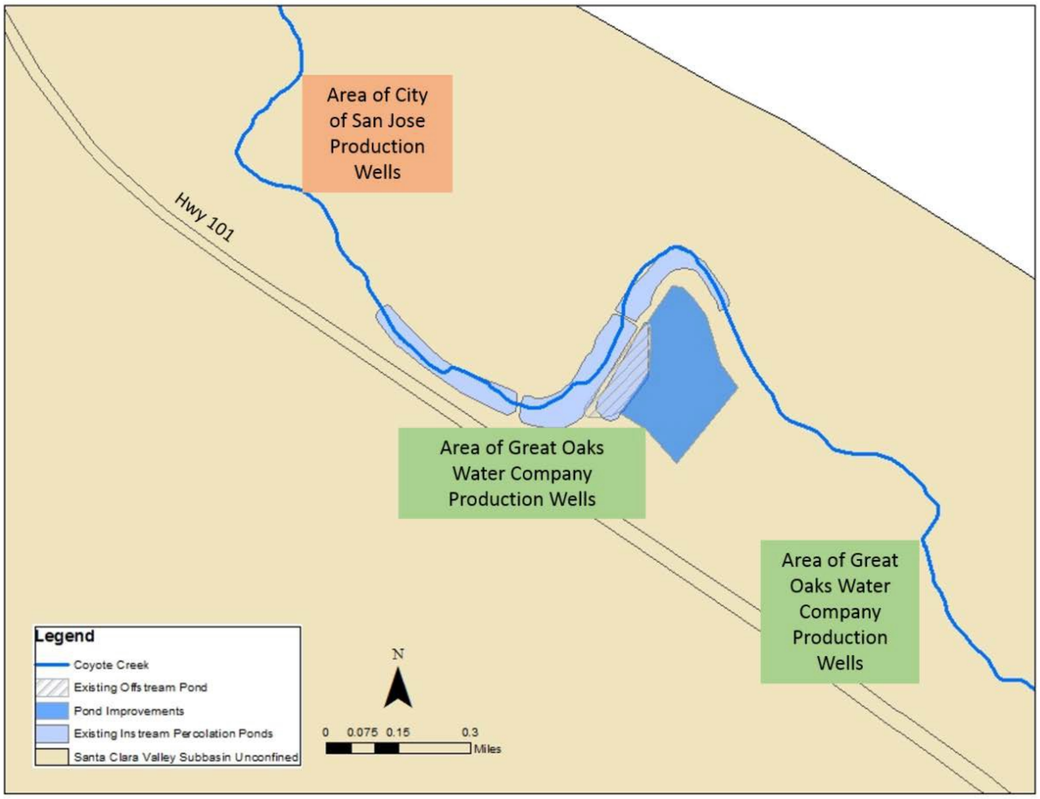
3.1 Hydrogeologic Assessment

This hydrogeologic assessment considers the use of new or enlarged off-stream recharge ponds that would be located at or near the existing Ford Pond site. The ponds would be used for IPR of purified recycled water instead of stormwater and imported water recharge historically done in the area. Aquifer characteristics, hydraulic properties, depth to groundwater, and groundwater flow conditions were assessed relative to recharge potential. Estimates of groundwater flow directions and rates along with distances to nearby production wells were used to assess travel times relative to State Water

Site Location

The proposed Ford Pond project GWR recharge site is located adjacent to Coyote Creek in the recharge (unconfined) area of the Santa Clara Groundwater Subbasin. Figure 3-1 shows the Coyote Creek area at the southern end of the Santa Clara Subbasin, the former and existing Ford Pond project in-stream and off-stream recharge ponds, the proposed pond improvement/enlargement, and nearby San José City

Figure 3-1: Ford Pond Recharge Area


Area of City of San Jose Production Wells
Hwy 101
Area of Great Oaks Water Company Production Wells
Area of Great Oaks Water Company Production Wells
Legend
Coyote Creek
Existing Offstream Pond
Pond Improvements
Existing Instream Percolation Ponds
Santa Clara Valley Subbasin Unconfined
N
0 0.075 0.15 0.3
Miles

Existing and Improved Recharge Ponds

The historical Ford Pond project recharge ponds are part of the District's Coyote Creek recharge pond system. The historical Ford Pond was comprised of several in-stream and one off-stream pond. The

Recharge operations at the Ford Pond occurred between January 1996 and December 1998. During this period, an average of 185 acre-feet per month (AFM) or 2,221 acre-feet per year (AFY) was recharged at an average infiltration rate of approximately 1.66 feet per day (ft/d).

Assuming a recharge capacity of 1 to 2 cubic feet per second (cfs) for the existing 3.7-acre off-stream Ford Pond, an additional area of up to 15 acres would need to be added to the existing off-stream pond to accommodate the purified water recharge. Improvement to the existing Ford Pond project recharge pond site would involve excavating a larger recharge basin that encompasses and expands the existing off-stream pond. Figure 3-1 also shows the areas of the existing and proposed expanded off-stream

A pond location that provides a greater separation with Coyote Creek could be beneficial to reduce the potential leakage of recycled water from the ponds into Coyote Creek. If leakage into the creek occurs, then a NPDES permit would be required. A more detailed siting study would be required to identify alternative site locations and evaluate which specific site is best to locate the project's treatment plant and expanded spreading basins. The recharge pond siting issues are discussed in more detail in the

Production Wells

Several municipal drinking water supply wells are located in the vicinity of the proposed recharge site shown in Figure 3-1. These wells are owned by Great Oaks Water Company and the City of San José. The closest production wells to the Ford Pond project site are wells owed by Great Oaks Water Company (Wells 15, 21 and 18). The Great Oaks Water Company Well 15 is approximately 1,700 feet west-southwest, Well 21 is around 150 feet to the southwest, and Well 18 is about 2,700 feet southeast of the proposed enlarged recharge pond. The City of San José Wells EDV 11, 12, and 13 are located between 3,800 and 4,500 feet north-northwest of the proposed enlarged recharge pond. The Great Oaks Water Company Wells 15 and 21 are 270 and 230 feet deep, while the City of San José Wells EDV 11, 12, and 13 are each 360 feet deep. The producing groundwater aquifer is unconfined in this area of

Stratigraphy and Aquifer Characteristics

The Ford Pond project site is in the unconfined or forebay portion of the Santa Clara Groundwater Subbasin. In this area, the regional Bay Mud aquitard is not present, and groundwater recharge occurs along the streams and mountain fronts. The deeper Principal Aquifer, which becomes confined further to the northwest in the Santa Clara Subbasin, is recharged from these forebay areas where unconfined

The aquifer materials in the Ford Pond project area are comprised of high permeability sands and gravels overlying less permeable bedrock. The site is located in the Edenvale subarea of the forebay, just northwest of the Coyote area of the Santa Clara Subbasin and the Coyote Narrows. The unconsolidated sedimentary aquifer depositional environment is very high energy, due to the topographic grade and convergence of surface water flow through the narrow gap in the bedrock hills on both sides of Coyote Narrows. The unconsolidated sands and gravels deposited by Coyote Creek in this area are coarse-grained and very permeable. The thickness of the unconsolidated sand and gravel

Aquifer Hydraulic Properties

Hydraulic conductivity, effective porosity, and hydraulic gradient are parameters used to estimate travel time from the proposed recharge pond to nearby potable water supply production wells. The hydraulic conductivity in the vicinity of the proposed recharge site is determined based on data presented in the Santa Clara Valley Groundwater Modeling documentation and other sources (CH2M Hill, 1992a and 1992b) The calibrated hydraulic conductivity used for basin-wide modeling in the vicinity of the Ford

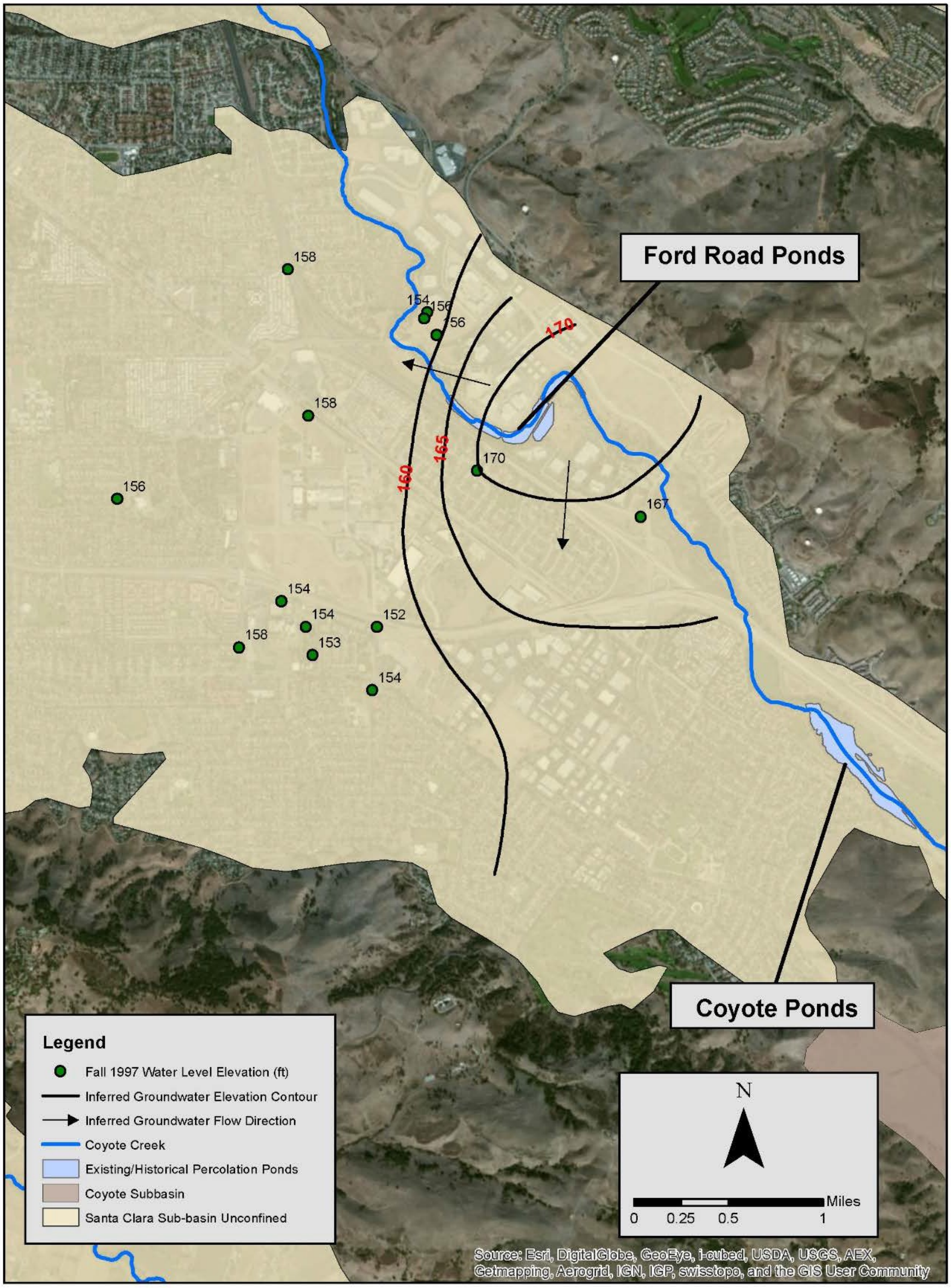
However, this value may not be representative in the most permeable areas around the Ford Pond site. The Santa Clara Valley Groundwater Model was developed for basin-wide groundwater management purposes and used uniform values of hydraulic conductivity over large areas of the model. Several local aquifer pumping and recovery tests were performed at the IBM site located a little over one mile southwest of the Ford Pond, and the data derived from these tests were analyzed to estimate aquifer permeabilities. The aquifer test data are of good quality, with a fairly narrow range of estimated aquifer permeabilities (Kennedy/Jenks, 1987). Estimated hydraulic conductivities from the aquifer tests were in the range of 0.14 to 2.7 feet per minute (approximately 200 to 3,900 ft/d). The estimated hydraulic conductivity values derived from the tests are much higher than the value used in the Santa Clara Valley Groundwater Modeling, and likely reflect the hydraulic properties of the most permeable sand channel

Based on the characteristics of the high-permeability sand and gravel deposits an effective porosity of 0.2 is assumed.

Groundwater Flow and Elevations

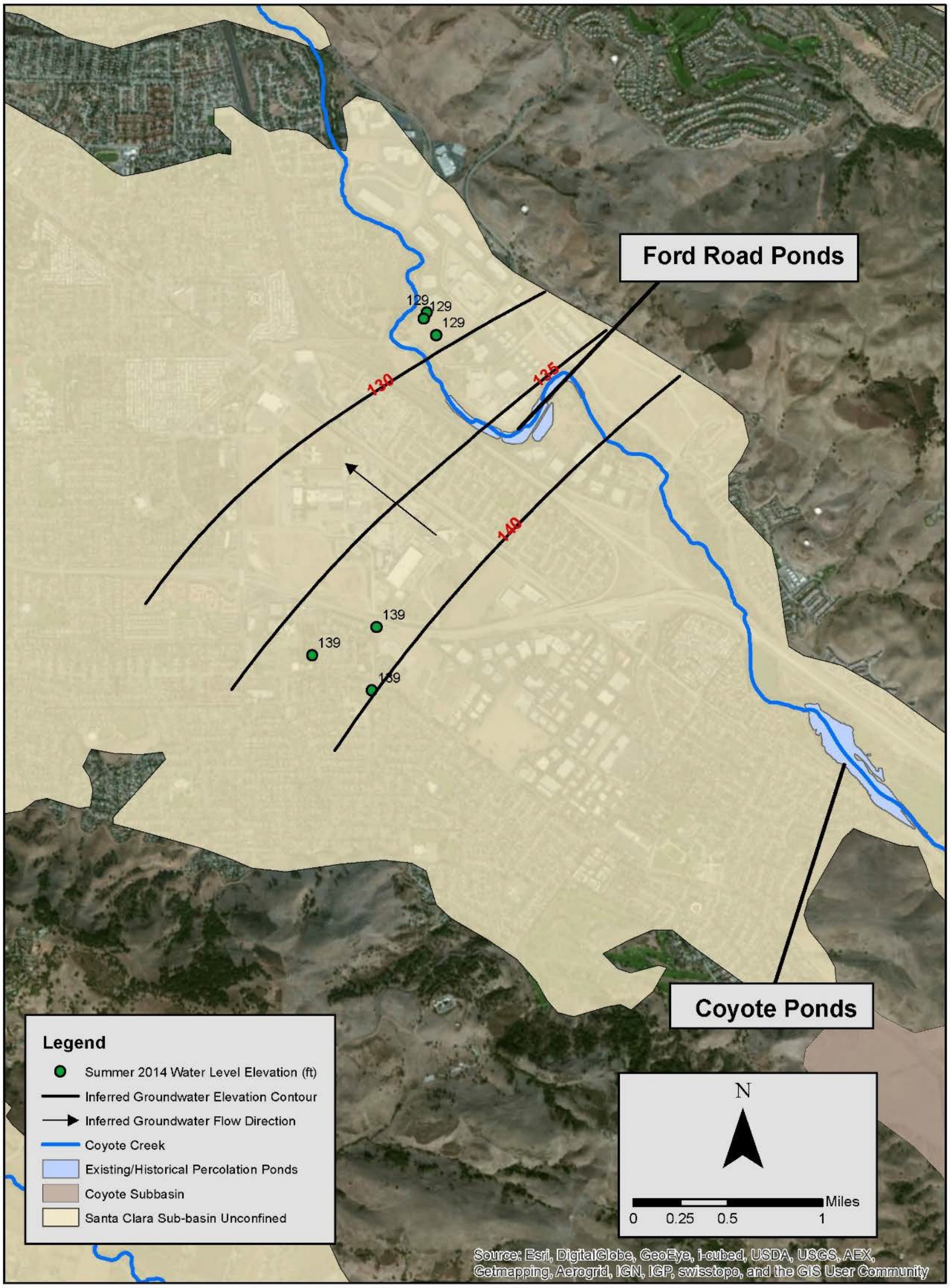
Historical groundwater elevations in Ford Pond area wells were reviewed to estimate groundwater flow rates and retention times for recharged purified water. Historical groundwater elevations fluctuate over time and in response to seasonal recharge, groundwater production, and recharge operations at the Ford Pond. Figures 3-2 and 3-3 show groundwater elevations in the Ford Pond area during Fall 1997, when the Ford Ponds were being operated to recharge water and during the Summer 2014 an flows generally northward toward San Francisco Bay (Figure 3-3). However, when significant amounts of water are recharged at the Ford Pond, a water table mound forms, and the local groundwater flow directions are radial, away from the ponds as shown on Figure 3-2.

Figure 3-2: Groundwater Elevations in Fall 1997


Ford Road Ponds
Coyote Ponds
158
154
156
56
170
158
165
160
170
156
167
154
154
152
158
153
154
Legend
● Fall 1997 Water Level Elevation (ft)
Inferred Groundwater Elevation Contour
Inferred Groundwater Flow Direction
Coyote Creek
Existing/Historical Percolation Ponds
Coyote Subbasin
Santa Clara Sub-basin Unconfined
N
Miles
0
0.25
0.5
1

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3-3: Groundwater Elevations in Summer 2014


Ford Road Ponds
129
129
129
130
135
140
139
139
139
Coyote Ponds
Legend
● Summer 2014 Water Level Elevation (ft)
Inferred Groundwater Elevation Contour
Inferred Groundwater Flow Direction
Coyote Creek
Existing/Historical Percolation Ponds
Coyote Subbasin
Santa Clara Sub-basin Unconfined
N
Miles
0
0.25
0.5
1

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

During Fall 1997, when the Ford Ponds were recharging around 500 AFM, groundwater flowed in a radial manner away from the ponds with hydraulic gradients of approximately 0.0063 foot/foot. For the proposed Ford Pond project IPR project recharging 350 AFM (or 3.75 mgd), similar flow directions and

The actual height of the recharge mound beneath an expanded Ford Pond project is dependent on the recharge rate, pond area, and local hydraulic properties of the aquifer. Potential mounding and flowpaths from the expanded recharge pond to downgradient areas will need to be more accurately simulated with groundwater modeling. Under non-recharging conditions, such as during Summer 2014

Groundwater Quality

A review of State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) water quality data available on the online at the GeoTracker GAMA website for nearby potable water supply

A Black & Veatch - Kennedy/Jenks (B&V – KJ) study conducted for the District (B&V, 2003) concluded that groundwater recharge using advanced treatment significantly reduces most contaminant levels, and if reverse osmosis (RO) is coupled with ultraviolet light (UV) treatment in an advanced oxidation process (primarily to address disinfection by-products), recharge would appear to have no negative

For surface recharge projects, clogging of infiltrated aquifer media due to total suspended solids (TSS), biological growth, and chemical reactions can be a potential problem. However, because of low nutrient and TSS concentrations of advanced purified water, biological growth and physical clogging due to particulate materials should be minimal. The possibility of soil aquifer plugging problems due to clay expansion/dispersion could exist if advanced treated water with very low total dissolved solids (TDS) is introduces to an aquifer with water of higher TDS. The 2003 B&V – KJ report recommended additional

Changes in native groundwater quality can also result from geochemical reactions between recharge water and the aquifer matrix. For example, arsenic can be released by oxidation of interstitial pyrite by oxygenated recharge water. Arsenic mobilization has been observed at some (but not all) injection sites in marine limestone and some sandstone aquifer matrices (NGWA, 2014). This issue would need to be

Another water quality consideration is the potential impact to existing groundwater contamination areas from the injection of recycled water. The mounding associated with recycled water injection can alter local groundwater flow patterns, which can then change the shape, migration direction, and transport rates of contamination plumes thus affecting remedial facilities. Because the proposed Ford Pond IPR site is located in the unconfined portion of the Subbasin, mounding at the site could affect environmental release plumes. A review of environmental release sites in the vicinity of the Ford Pond west southwest of the potential recharge site. No other active sites were located within one mile of the Ford Pond IPR site.

3.2 Division of Drinking Water Requirements

The State Division of Drinking Water (DDW), formerly the California Department of Public Health, is now part of the State Water Resources Control Board (SWRCB). The DDW has developed the Groundwater Replenishment with Recycled Water regulations (Groundwater Replenishment (GWR) Regulations). The final GWR Regulations were adopted and went into effect on June 18, 2014 (SWRCB DDW, 2014). The GWR Regulations are organized by the type of project, including both (1) surface applications (surface spreading) and (2) subsurface applications (injection or vadose zone wells). A summary of the key

The GWR Regulations require that water used for recharge achieve at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment barriers. For each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than 1-log reduction. Typically, the final reduction is achieved within the aquifer, after injection or percolation, based on travel time credits of 1-log per each 1-month travel time for virus up to a maximum of 6-log credits. The needed travel time underground to achieve the required pathogen

The GWR Regulations also include provisions for the determination of a Response Retention Time (RRT), which is the time recycled water must be retained underground between recharge and extraction to allow a project sponsor ample time to identify treatment failures and implement appropriate actions to protect public health from inadequately treated recycled water or recharge water. The minimum RRT allowed is 2 months, but the proposed RRT must be approved by the SWRCB DDW. Based on other approved projects, the RRT is often measured in months, typically 4-6 months. For example, the RRT for

Table 3-1: DDW Regulations for Surface Application of Recycled Water

Parameter	Requirement
Treatment	Title 22 definitions of filtered wastewater and disinfected tertiary-treated recycled water
Total Organic Carbon (TOC)	Recycled water TOC = 0.5 mg/L
Response retention time (RRT)	Minimum time that recycled water will be retained underground to allow the project sponsor to respond to a treatment failure. Minimum of RRT of 2 months, but must be justified by the project sponsor. The RRT must be validated using an added tracer or DDW-approved intrinsic tracer
Pathogen reduction time	Time required for recycled water to be retained underground to meet virus reduction requirement: for each month underground, 1-log virus reduction credited
RWC	The RWC can be defined by volume and TOC. The recycled water applied at the GWR Project ÷ (recycled water + credited dilution water). The Initial RWC_{min} can be = 0.5 mg/L ÷ the maximum TOC concentration in the recycled
Initial RWC_{max}	Based on DDW review of the Engineering Report and information obtained as a result of the public hearing Can range from 20% up to 100%
Increased RWC_{max}	Up to 100% subject to additional requirements: 1) Updated Engineering Report and Operations Plan 2) Approval by DDW and RWQCB and RWQCB permit 3) For the previous 52 weeks, the TOC 20-week running average has not exceeded 0.5 mg/L
Dilution water compliance calculation	Based on 120-month running average
Groundwater monitoring	At least two monitoring wells downgradient of the injection well(s). 1. One monitoring well must be located between two weeks to six months travel time and at least 30 days upgradient of the nearest drinking water well; and 2. One monitoring well must be located between the injection well(s) and the nearest downgradient drinking water well. The monitoring wells must allow for samples to be obtained independently from each
Engineering Report	Proposed recycled water recharge project require submittal of an Engineering Report to DDW

Under the GWR Regulations, the pathogen reduction time and RRT can be demonstrated for planning purposed by analytical analysis such as Darcy's Law calculations or groundwater flow modeling. Because of inherent uncertainties in these methods, travel times calculated with a Darcy calculation are divided by 4 and travel times estimated with a groundwater flow model are divided by 2, for project planning purposes. So for example, if the greater of the RRT and pathogen reduction time is six months, a Darcy calculation would need to demonstrate a minimum of two years travel time to the nearest potable water supply well while a groundwater flow model would need to demonstrate a one year travel time.

The initial maximum recycled water contribution (RWC) for surface application projects must not exceed 0.20 or an alternative initial RWC approved by DDW. An alternative RWC up to 1.0 may be approved based on, but not limited to, the review of the project's Engineering Report, information obtained as a result of the public hearing(s), and a project sponsor's demonstration that treatment preceding soil aquifer treatment will reliably achieve a total organic carbon (TOC) concentrations no greater than 0.5 milligrams per liter (mg/L) divided by the proposed RWC. A project sponsor can increase the RWC if 1) it is approved by the DDW and Regional Water Quality Control Board (RWQCB); 2) for the previous 52 weeks, the TOC 20-week running average has not exceeded 0.5 mg/L ÷ $RWC_{proposed\ max}$; and 3) the permit allows the increase. The remainder of the water that replenishes the groundwater subbasin should come from non-recycled water sources, which can include surface water/stormwater, imported water,

Ultimately, a RWC of 100 percent or 1.0 can be achieved for a recharge project utilizing fully advanced treated recycled water (MF/RO/AOP), eliminating the need for diluent water. As examples, the three seawater intrusion barriers in Los Angeles County have received approval to move to 100 percent RWC and the Orange County Water District (OCWDs) has received approval to injection recycled water at a 100 percent RWC. A greater initial RWC was allowed for OCWD based on OCWDs demonstrated experience with recycled water recharge projects, illustrating the benefits of successfully implementing

Travel Time to Nearest Water Supply Wells

Darcy's Law was used to estimate groundwater velocities and travel time from the proposed Ford Pond project recharge site to the nearest drinking water supply wells. Darcy's law is the basic equation that

$$v = -K(\Delta h/\Delta l)/n$$

where v = average linear velocity in feet per day, K = hydraulic conductivity in feet per day, $\Delta h/\Delta l$ = hydraulic gradient in foot/foot (h = head and l = distance), and n = effective porosity in percent.

As noted above, because of uncertainties associated with the Darcy equation parameters, DDW requires the application of a safety factor of four to the travel time estimate developed with the Darcy equation.

Figure 3-2 shows groundwater elevations in Fall 1997 in wells in the vicinity of the proposed recharge site during a period of active managed recharge operations similar to proposed purified water recharge operations. Based on an assumed hydraulic gradient of 0.0063 foot/foot away from the recharge pond, a horizontal hydraulic conductivity of 200 ft/day, and an effective porosity of 0.2, the estimated

Based on the calculated velocity of 6.3 ft/d, the estimated travel times to the two closest Great Oaks Water Company water supply wells (Wells 21 and 15, located 150 and 1,700 feet from the proposed recharge pond) are approximately 24 and 270 days (or less than one month and nine months), respectively. With the DDW-required method correction, this yields modified travel times of only 6 and 67 days (or significantly less than one month and two months). Based on the range of typical RRT and pathogen reduction travel time for other recycled water injection sites (four to six months), these preliminary calculations indicate that recycled water recharge in the vicinity of Wells 21 and 15 would not meet the GWR regulatory criteria for subsurface retention time. Solely based on these Darcy calculations, these wells would be impacted by the Ford Pond project if implemented. Groundwater

Using the same groundwater velocity, the travel time to City of San José Wells EDV 11, 12, and 13, located between 3,800 and 4,500 feet north-northwest of the Ford Pond project site, is 603 to 714 days (or 20 and 23 months). With the DDW-required method correction, this yields a modified travel time of 151 to 179 days (or five and 6 months) indicating the GWR regulatory criteria could likely be met for

If the Ford Pond IPR project moves forward, it is recommended that more technically-rigorous travel time estimates be developed with groundwater flow modeling, which would allow use of a less restrictive correction factor. However, even with groundwater modeling, it is likely that Great Oaks Water Company Well 21 could be impacted by the recycled water project. Mitigation measures could include reconstructing the wells in a location outside of the impacted area or moving the percolation

Diluent Water

DDW has allowed advanced treated recycled water recharge projects to start at a 100 percent RWC or to move to a 100 percent RWC over time. Therefore, it is possible that the Ford Pond IPR project could be approved at an initial 100 percent RWC. DDW has also allowed dilution water credit for native groundwater flowing through the zone of influence of recharged recycled water for other recycled water

A preliminary estimate of the volume of native groundwater flowing through the estimated recharged recycled water zone of influence was made using Darcy's Law. Darcy's Law states that:

$$Q = K \times i \times A$$

where Q = flow, K = hydraulic conductivity of the aquifer, i = hydraulic gradient, and A = cross sectional area of the aquifer perpendicular to the direction of the flow (the product of the aquifer saturated thickness and width of the purified water spreading zone).

Using the hydraulic conductivity of 200 ft/d, a regional hydraulic gradient of 0.0063, and a cross sectional area of approximately 1,200,000 square feet (ft^2), the Darcy equation yields a native groundwater flow rate of approximately 1,500,000 cubic feet per day (ft^3/d) or 9.0 mgd. The cross section area used in the equation assumes an average saturated aquifer thickness of 300 feet and a cross sectional width of 4,000 feet (based on the size of the recharge mound inferred from Fall 1997 water levels) and assumes that the recycled water will spread out in a mound of approximately that size. Based on this calculation, the native groundwater flowing through the recharged recycled water zone of influence is 9 mgd, which yields a RWC of 29 percent assuming recharge of 3.75 mgd of recycled water. This RWC is reasonably close to the DDW recommended initial RWC of 20 percent that an alternative initial RWC of 29 percent might meet with DDW approval. Since the Ford Pond project would percolate AWPF treated water, the TOC of the project water would be less that a media filtered recycled water, so a higher initial RWC could be considered by DDW. Also, other projects have been approved with higher RWC's after the owners have showed DDW that they can successfully operate a recycled water project.

Groundwater flow modeling using a calibrated numerical model is recommended to provide a more technically-rigorous estimate of the percentage of recycled water in nearby water supply wells. According to the DDW GWR Regulations, the initial maximum RWC for the project will be based on the

Monitoring Wells

Locations and construction details for monitoring wells will be developed after modeling is conducted to better simulated groundwater flow and travel times under proposed project operations.

Engineering Report

The numerous requirements for the Engineering Report for a recycled water groundwater replenishment reuse project are described in the GWR Regulations (SWRCB DDW, 2014). This TM is not intended to fulfill the DDW requirements for an Engineering Report. Rather, this TM is intended to provide a preliminary feasibility assessment of the Ford Pond IPR project, specifically focused on whether estimated travel times to the nearest potable water supply wells will likely meet the DDW

3.2 Regional Water Quality Control Board

The San Francisco RWQCB regulates groundwater replenishment projects in the San Francisco Bay Area under numerous state laws and regulations, including the Water Quality Control Plan (Basin Plan) (December 31, 2011) and SWRCB Policies. The Basin Plan requirements include designated uses and groundwater objectives using both numeric and narrative requirements to protect those uses. The Basin Plan also applies the state's Anti-degradation Policy, which is further interpreted pursuant to the

The Ford Pond IPR project will necessitate issuance of Waste Discharge and Water Recycling Requirements (WDRs/WRRs) by the San Francisco Region RWQCB. The WDRs/WRRs will establish monitoring and reporting requirements. In addition, if the pond is shown to discharge to Coyote Creek,

3.3 Planned Groundwater Flow Modeling

The District has a calibrated MODFLOW groundwater flow model of the Santa Clara Subbasin (CH2M Hill, 1992). The District staff may need to refine the flow model to create a local-scale groundwater model. The local scale groundwater model would be used to simulate recycled water recharge and groundwater extraction from existing production wells in the area. The model would also be used to estimate travel time to and the percentage of recycled water extracted from nearby production wells in

3.4 Conclusions

Based on this preliminary analysis, the proposed Ford Pond IPR project appears feasible and a 3.75-mgd recharge project can likely meet DDW GWR regulatory requirements. Potential impacts to nearby Great Oaks Water Company production wells from the project will need to be assessed and addressed. Note that several assumptions have been made in conducting the preliminary Darcy calculations and additional groundwater modeling is proposed to refine estimates presented here and provide a more technically-rigorous analysis of travel time and dilution provided by native groundwater flowing through

Prior to moving forward with the project, additional analysis of potential water quality impacts will need to be addressed including:

1) the potential for contamination mobilization due to geochemical reactions between recharged purified water and native groundwater,
2) the potential for soil aquifer plugging due to differences in water quality between purified water and native groundwater, and
3)

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Appendix 7C - Conceptual Cost Estimates

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Project: **SBWR Strategic and Master Plan**

Component: **Phase 1 - Mid-Basin Injection Wells IPR (Option A)**

Date: April 1, 2014
Updated: December 1, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 19,353,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 16,399,000	
15 - Mechanical	$ 64,000	
16 - Electrical	$ 3,280,000	
17- I&C	$ 1,640,000	

RAW CONSTRUCTION COST		**$ 40,736,000**	
Construction Contingency	20%	$ 8,147,000	
BASE CONSTRUCTION COST		**$ 48,883,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 14,665,000	
Easements		$ 106,000	
Project Contingency	10%	$ 6,365,000	
Land Acquisition Cost		$ 6,836,000	Adapted from District's TM.8C, which estimated that 21 acres of land acquisition cost $17.1M.
TOTAL PROJECT COST		**$ 76,855,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 19,353,000**	
	Product pipeline	42	in	17,000	LF	$ 16.00	$ 11,424,000	Trenched 42" line towards Los Gatos
	Lateral pipeline	18	in	23,000	LF	$ 16.00	$ 6,624,000	Trenched connection to mid-basin wells
	42" hwy x'ings (x1)	18	in	250	LF	$ 30.00	$ 135,000	Trenchless, adapted from TM 8B
	18" hwy x'ings (x1)	18	in	250	LF	$ 30.00	$ 135,000	Trenchless, adapted from TM 8B
	18" river x'ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless, adapted from TM 8B
	Bore & Jack Pits	-	-	6	EA	$ 91,400.00	$ 548,000	
	Wells laterals	8	in	1,500	LF	$ 16.00	$ 24,000	
	Backflush piping	8	in	2,560	LF	$ 16.00	$ 328,000	Adapted on District's TM.8C
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,399,000**	
	PWPS	300	hp	1	EA	$ 5,146	$ 1,544,000	Pump station to mid-basin injection
	Injection wells	-	-	8	EA	$ 1,350,000	$ 10,800,000	Adapted from TM.8C costs w/o contingency
	AOP system	-	-	1	LS	$ 2,566,447	$ 2,566,000	Adapted from project with similar capacity
	AOP Mechanical/Piping Allowance					25%	$ 642,000	
	AOP Installation Allowances					15%	$ 385,000	
	AOP Building/Canopies Allowance					18%	$ 462,000	

Project:	**SBWR Strategic and Master Plan**	Date:	April 1, 2014
		Updated:	December 1, 2014
Component:	**Phase 1 - Mid-Basin Injection Wells IPR (Option A)**	Project Number:	0057-007.02
		Prepared by:	AG/JKT

Estimate Type: Conceptual Planning

15 - Mechanical							**$ 64,000**	
	Hydrogen peroxide tank & pumps			1	EA	$ 40,500	$ 41,000	Adapted from similar project.
	H2O2 Mechanical/Piping Allowance					25%	$ 10,000	
	H2O2 Installation Allowances					15%	$ 6,000	
	H2O2 Building/Canopies Allowance					18%	$ 7,000	
16 - Electrical							**$ 3,280,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 3,280,000	
17 - I&C							**$ 1,640,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 1,640,000	
EASEMENT ACQUISITION							**Total Cost**	
	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 106,000**	
	18" pipeline	18	in	23,000	LF	$ 4.60	$ 106,000	Lateral to mid-basin well field
							$ -	from main alignmment to Los Gatos
ANNUAL O&M COSTS				**Amount**	**Unit**	**Value**	**Cost**	
Consumables						Total Consumables	**$ 403,000**	
	Equipment Consumables			$ 16,399,000		2%	$ 401,000	2% of Equipment
	Mechanical Consumables			$ 64,000		2%	$ 1,000	2% of Mechanical
	Instrumentation Consumables			$ 1,640,000		2%	$ 1,000	2% of Instrumentation
Power Costs						Total Power	**$ 1,268,000**	
	SVAWPC				Horsepower			
					Hours per year operation			
					Annual Cost		$ 1,103,000	$3.8M FY-14 budget for SVAWPC, assume
	PWPS				Horsepower	300		only for 2,600 AFY
					Hours per year operation	3,465		Assume pumps 2,600 AFY which is
					Annual Cost		$ 116,000	non-continuous annually
	AOP				Horsepower			
					Hours per year operation			
					Annual Cost		$ 49,000	Adpated from similar FAT project
Chemicals						Total Chemicals	**$ 59,000**	
	AOP H_2O_2			24,631	gal	$ 5.60	$ 59,000	Adpated from similar FAT project
							$ -	
							$ -	
Labor Costs						Total Labor	$ -	
	Total # Operators				number			
	Average Annual Hours per operator				hrs/yr			
	Total Operators per year				Total hrs	$ 75	**$ -**	Included in injection well costs, see below
Other Costs						Total Other	**$ 600,000**	
	RWF Secondary Effluent			0	AFY		$ -	Assume no cost
	Injection well O&M			8	number	$ 75,000.00	$ 600,000	Adapated from similar injection project
					TOTAL ANNUAL O&M COSTS		**$ 2,330,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 1 - Ford Pond IPR (Option B)

Date: April 1, 2014
Updated: December 1, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 9,093,900	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 2,819,850	
15 - Mechanical	$ 30,000	
16 - Electrical	$ -	
17- I&C	$ -	

	RAW CONSTRUCTION COST	**$**	**11,943,750**	
Construction Contingency	20%	$	2,389,000	
	Satellite AWPF		$23,000,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$**	**37,333,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$	11,200,000	
Easements		$	56,000	
Project Contingency	10%	$	4,858,900	
Sanitary Sewer/Treatment Plant Connection Fee		$	4,000,000	Allowance based on MEC connection fees
Land Acquisition Cost		$	6,957,000	Land cost for 20 acres
	TOTAL PROJECT COST	**$**	**64,405,000**	(15 acres ponds and 5 acres AWPF)
				Land cost based on District's Coyote IPR TM (TM 8A)
				$8m for 18 acres of pond and 5 acres
				for an AWPF

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 9,093,900**	
	Source pipeline	14	in	3,696	LF	$ 16.00	$ 828,000	Pipeline from Silver Creek Pipeline
	Product pipeline	14	in	9,504	LF	$ 16.00	$ 2,129,000	Pipeline to Ford Ponds
	Discharge sewer	8	in	2,640	LF	$ 16.00	$ 338,000	Sewer for AWPF waste
	Railroad crossings (x1)	8	in	100	LF	$ 30.00	$ 24,000	Railroad crossing between Great Oaks
	Railroad crossings (x1)	14	in	100	LF	$ 30.00	$ 42,000	Blvd and Monterey Rd for all pipelines.
	Railroad crossings (x1)	14	in	100	LF	$ 30.00	$ 42,000	Assume share bore and jack pit for all
	Bore & Jack Pits	-	-	6	EA	$ 91,400.00	$ 548,400	three crossings
	Ford Ponds site	15	ac	205,700	CU YD	$ 25.00	$ 5,142,500	Civil sitework allowance for creating new
							$ -	ponds and berms (85% of 15 total acres, 10 ft deep)
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	

Project: **SBWR Strategic and Master Plan**

Component: **Phase 1 - Ford Pond IPR (Option B)**

Date: April 1, 2014
Updated: December 1, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

Estimate Type: Conceptual Planning

11 - Equipment								**$**	**2,819,850**	
	AOP System	0.0	mgd	1	LS	$	1,898,695.51	$	1,899,000	AOP from similar FAT project
	AOP Installation Allowances						15%	$	284,850	
	PWPS	75	hp	1	EA	$	8,476	$	636,000	Pump station to Ford Ponds
15 - Mechanical								**$**	**30,000**	
	H2O2 tank + pumps + allowances			1	EA	$	29,963	$	30,000	Adapted from similar project.
16 - Electrical								**$**	**-**	
Electrical Substation								$	-	
Electrical Allowance	20% of Division 11 (Equipment)						Included in Satellite AWPF cost	$	-	
17 - I&C								**$**	**-**	
I&C Allowance	10% of Division 11 (Equipment)						Included in Satellite AWPF cost	$	-	

EASEMENT ACQUISITION

Item	**Size**	**Units**	**Quantity**	**Unit**		**Unit Cost**	**$**	**Total Cost** **56,000**	
8" pipeline	8	in	2,640	LF	$	4.60	$	12,000	Sewer easement on Great Oaks
14" pipeline	14	in	9,504	LF	$	4.60	$	44,000	Pipeline easement to Ford Ponds

ANNUAL O&M COSTS			**Amount**	**Unit**		**Value**		**Cost**	
Consumables						Total Consumables	**$**	**601,000**	
	Equipment Consumables	$	21,986,517			2%		$600,000	2% of Equipment
	Mechanical Consumables	$	30,000			2%	$	1,000	2% of Mechanical
	Instrumentation Consumables	$	-			2%	$	-	2% of Instrumentation
Power Costs						Total Power		**$871,000**	
	Satellite AWPF			Horsepower					
				Hours per year operation					
				Annual Cost				$719,000	Adapted from District's TM 8A
	PWPS			Horsepower		75			
				Hours per year operation		8,059			
				Annual Cost				$68,000	Pumping to Ford Ponds for recharge
	AOP			Horsepower					
				Hours per year operation					
				Annual Cost				$84,000	Adpated from similar FAT project
Chemicals						Total Chemicals	**$**	**342,000**	
	AWPF Chemicals						$	342,000	Adapted from District's TM 8A + AOP from similar
							$	-	FAT project
							$	-	
Labor Costs						Total Labor	**$**	**900,000**	
	Total # Operators			number					
	Average Annual Hours per operator			hrs/yr					
	Total Operators per year		0	Total hrs	$	75	$	900,000	Adapted from District's TM 8A
Other Costs						Total Other	**$**	**1,392,000**	
	Annual Sewer Discharge Fee						$	1,392,000	San Jose Industrial Discharge Sewer Fee
	SBWR Water		5,600	AFY			$	-	TBD
	Recharge pond O&M								TBD
				TOTAL ANNUAL O&M COSTS			**$**	**4,106,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 2 - Alternative 1 (IPR)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 48,662,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 16,129,000	
15 - Mechanical	$ 150,000	
16 - Electrical	$ 3,226,000	
17- I&C	$ 520,000	

	RAW CONSTRUCTION COST	**$ 68,687,000**	
Construction Contingency	20%	$ 13,737,000	
	Centralized AWPF	$ 115,000,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 197,424,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 59,227,000	
Easements		$ -	
Project Contingency	10%	$ 25,665,000	
Land Acquisition Cost			
	TOTAL PROJECT COSTS	**$ 282,316,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 48,662,000**	
	Product pipeline	36	in	73,310	LF	$ 16.00	$ 42,227,000	Trenched pipeline to Los Gatos
	Hwy x'ings (x9)	36	in	2250	LF	$ 30.00	$ 2,430,000	Trenchless, adapted from District TM.8B
	Rail x'ings (x5)	36	in	500	LF	$ 30.00	$ 540,000	Trenchless, adapted from District TM.8B
	River x/ings (x2)	36	in	500	LF	$ 30.00	$ 540,000	Trenchless, adapted from District TM.8B
	Bore & Jack Pits	-	-	32	EA	$ 91,400.00	$ 2,925,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,129,000**	
	AOP System	20.0	mgd	1	LS	$ 9,505,359.26	$ 9,505,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 1,426,000	
	PWPS	2000	hp	1	EA	$ 2,599	$ 5,198,000	Pump station to Los Gatos Ponds
15 - Mechanical							**$ 150,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 150,000	$ 150,000	Adapted from similar FAT project.

Project: SBWR Strategic and Master Plan

Component: Phase 2 - Alternative 1 (IPR)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

16 - Electrical			**$**	**3,226,000**	
Electrical Substation			$	-	
Electrical Allowance	20% of Division 11 (Equipment)	20%	$	3,226,000	AOP and PWPS only
17 - I&C			**$**	**520,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$	520,000	PWPS only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 2,252,000**	
	Equipment Consumables	$ 111,962,333		2%	$ 2,239,000	2% of Equipment
	Mechanical Consumables	$ 150,000		2%	$ 3,000	2% of Mechanical
	Instrumentation Consumables	$ 520,000		2%	$ 10,000	2% of Instrumentation
Power Costs				Total Power	**$ 6,223,000**	
	AWPF		Horsepower			
			Hours per year operation			
			Annual Cost		$ 4,000,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	2,000		
			Hours per year operation	8,059		
			Annual Cost		$ 1,801,000	Pumping to Los Gatos Ponds
	AOP		Horsepower			
			Hours per year operation			
			Annual Cost		$ 422,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 1,586,000**	
	AWPF Chemicals				$1,586,000	Adapted from SVAWPC Engineer's Report + AOP from similar FAT project
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	**$ 1,560,000**	$75/hr
Other Costs				Total Other	**$ -**	
	Recharge Pond O&M				$ -	TBD
	RWF Secondary Effluent				$ -	Assume no cost
	TOTAL ANNUAL O&M COSTS				**$ 11,621,000**	

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: Phase 2 - Alternative 2 (IPR + DPR)

Prepared by: AG/JKT

AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 43,886,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 16,129,000	
15 - Mechanical	$ 150,000	
16 - Electrical	$ 3,226,000	
17- I&C	$ 520,000	

			Notes
	RAW CONSTRUCTION COST	**$ 63,911,000**	
Construction Contingency	20%	$ 12,782,000	
	Centralized AWPF	$ 115,000,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 191,693,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 57,508,000	
Easements		$ -	
Project Contingency	10%	$ 24,920,000	
Land Acquisition Cost			
	TOTAL PROJECT COST	$ 274,121,000	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 43,886,000**	
	Product pipeline	36	in	31,070	LF	$ 16.00	$ 17,896,000	Trenched pipeline to Los Gatos
	Product pipeline	30	in	41,208	LF	$ 16.00	$ 19,780,000	Trenchless, adapted from District TM.8B
	Hwy x'ings (x4)	36	in	1000	LF	$ 30.00	$ 1,080,000	Trenchless, adapted from District TM.8B
	Hwy x'ings (x5)	30	in	1250	LF	$ 30.00	$ 1,125,000	Trenchless, adapted from District TM.8B
	Rail x'ings (x5)	36	in	500	LF	$ 30.00	$ 540,000	
	River x/ings (x2)	36	in	500	LF	$ 30.00	$ 540,000	
	Bore & Jack Pits	-	-	32	EA	$ 91,400.00	$ 2,925,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,129,000**	
	AOP System	20.0	mgd	1	LS	$ 9,505,359.26	$ 9,505,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 1,426,000	
	PWPS	2000	hp	1	EA	$ 2,599	$ 5,198,000	Pump station to Los Gatos Ponds
15 - Mechanical							**$ 150,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 150,000	$ 150,000	Adapted from similar FAT project.

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: Phase 2 - Alternative 2 (IPR + DPR)

Prepared by: AG/JKT

AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

16 - Electrical			**$ 3,226,000**	
Electrical Substation			$ -	
Electrical Allowance	20% of Division 11 (Equipment)	20%	$ 3,226,000	AOP and PWPS only
17 - I&C			**$ 520,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$ 520,000	PWPS only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 2,252,000**	
	Equipment Consumables	$ 111,962,333		2%	$ 2,239,000	2% of Equipment
	Mechanical Consumables	$ 150,000		2%	$ 3,000	2% of Mechanical
	Instrumentation Consumables	$ 520,000		2%	$ 10,000	2% of Instrumentation
Power Costs				Total Power	**$ 6,674,000**	
	AWPF		Horsepower			
			Hours per year operation			
			Annual Cost		$ 4,000,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	2,500		
			Hours per year operation	8,059		
			Annual Cost		$ 2,252,000	Pumping to Los Gatos Ponds
	AOP		Horsepower			
			Hours per year operation			
			Annual Cost		$ 422,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 1,586,000**	
	AWPF Chemicals				$1,586,000	Adapted from SVAWPC Engineer's Report + AOP from similar FAT project
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	**$ 1,560,000**	$75/hr
Other Costs				Total Other	**$ -**	
	Recharge Pond O&M				$ -	TBD
	RWF Secondary Effluent				$ -	Assume no cost
			TOTAL ANNUAL O&M COSTS		**$ 12,072,000**	

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: Phase 2 - Alternative 3 (DPR)

AWPF Design Capacity 29.2 mgd
AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

Prepared by: AG/JKT

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 21,003,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 24,695,000	
15 - Mechanical	$ 1,938,000	
16 - Electrical	$ 4,939,000	
17- I&C	$ 874,000	

	RAW CONSTRUCTION COST		**$ 53,449,000**	
Construction Contingency		20%	$ 10,690,000	
	Centralized AWPF		$ 167,900,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST		**$ 232,039,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 69,612,000	
Easements			$ -	
Project Contingency		10%	$ 30,165,000	
Land Acquisition Cost				
	TOTAL PROJECT COST		**$ 331,816,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 21,003,000**	
	Product pipeline	36	in	33,320	LF	$ 16.00	$ 19,192,000	Trenched connection to central pipeline
	Hwy x'ings (x3)	36	in	750	LF	$ 30.00	$ 810,000	Trenchless, adapted from District TM.8B
	River x/ings (x1)	36	in	250	LF	$ 30.00	$ 270,000	Trenchless, adapted from District TM.8B
	Bore & Jack Pits	-	-	8	EA	$ 91,400.00	$ 731,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 24,695,000**	
	AOP System	29.2	mgd	1	LS	$ 13,877,824.52	$ 13,878,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 2,082,000	
	PWPS	4500	hp	1	EA	$ 1,941	$ 8,735,000	Pump station to Central Pipeline

Project: SBWR Strategic and Master Plan

Component: Phase 2 - Alternative 3 (DPR)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Design Capacity 29.2 mgd
AWPF Production Capacity 20.0 mgd
Estimate Type: Conceptual Planning

15 - Mechanical					**$ 1,938,000**	
	H2O2 tank + pumps + allowances	1	EA	$ 219,000	$ 219,000	Adapted from similar FAT project.
	Chlorine tank + pumps + allownaces	1	EA	$ 219,000	$ 219,000	For free chlorine in introduction into raw water conveyance system
	Connection vault at Central Pipeline	1	LS	$ 1,500,000	$ 1,500,000	Sr. engineering estimate
16 - Electrical					**$ 4,939,000**	
Electrical Substation					$ -	
Electrical Allowance	20% of Division 11 (Equipment)			20%	$ 4,939,000	AOP and PWPS only
17 - I&C					**$ 874,000**	
I&C Allowance	10% of Division 11 (Equipment)			10%	$ 874,000	PWPS only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 3,348,000**	
	Equipment Consumables	$ 164,611,667		2%	$ 3,292,000	2% of Equipment
	Mechanical Consumables	$ 1,938,000		2%	$ 39,000	2% of Mechanical
	Instrumentation Consumables	$ 874,000		2%	$ 17,000	2% of Instrumentation
Power Costs				Total Power	**$ 6,899,000**	
	APWF	Horsepower				
		Hours per year operation				
		Annual Cost			$ 4,000,000	Adapted from SVAWPC Engineer's Report
	PWPS	Horsepower		2,750		
		Hours per year operation		8,059		
		Annual Cost			$ 2,477,000	Ramped down for 20 mgd flow in Phase 2
	AOP	Horsepower				
		Hours per year operation				
		Annual Cost			$ 422,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 1,967,000**	
	AWPF Chemicals				$ 1,586,000	Adapted from SVAWPC Engineer's Report
					$ -	+ AOP from similar FAT project
	Chlorine	381,171	gal	$ 1.00	$ 381,000	8 mg/L dose for free chlorine conveyance
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	**$ 1,560,000**	$75/hr
Other Costs				Total Other	**$ -**	
	RWF Secondary Effluent				$ -	Assume no cost
	TOTAL ANNUAL O&M COSTS				**$ 13,774,000**	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 2)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 11,136,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 764,000	
15 - Mechanical	$ -	
16 - Electrical	$ 153,000	
17- I&C	$ 76,000	

	RAW CONSTRUCTION COST		**$ 12,129,000**
Construction Contingency		20%	$ 2,426,000
	BASE CONSTRUCTION COST		**$ 14,555,000**
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 4,367,000
Easements			$ 170,000
Project Contingency		10%	$ 1,909,000
Land Acquisition Cost			
	TOTAL PROJECT COST		**$ 21,001,000**

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 11,136,000**	
	Brine pipeline	18	in	36,460	LF	$ 16.00	$ 10,500,000	Trenched pipeline to Coyote Point
	Railroad x'ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless crossing
	River x/ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless crossing
	Bore & Jack Pits	-	-	4	EA	$ 91,400.00	$ 366,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 764,000**	
	Pump station	100	hp	1	EA	$ 7,642	$ 764,000	Pumping to Coyote Point
15 - Mechanical							**$ -**	
							$ -	
16 - Electrical							**$ 153,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 153,000	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 2)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

17 - I&C			**$ 76,000**
I&C Allowance	10% of Division 11 (Equipment)	10%	$ 76,000

EASEMENT ACQUISITION

	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
							$ 170,000
	Brine pipeline	18	in	36,960	LF	$ 4.60	$ 170,000

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 17,000**	
	Equipment Consumables	$ 764,000		2%	$ 15,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$ -	2% of Mechanical
	Instrumentation Consumables	$ 76,000		2%	$ 2,000	2% of Instrumentation
Power Costs				Total Power	**$ 90,000**	
	Pump station		Horsepower	100		
			Hours per year operation	8,059		
			Annual Cost		$ 90,000	Pumping to Coyote Point outfall
Chemicals				Total Chemicals	**$ -**	
					$ -	
					$ -	
					$ -	
Labor Costs				Total Labor	**$ 31,000**	
	Total # Operators	2	number			
	Average Annual Hours per operator	208	hrs/yr			Assume weekly inspection and cleaning.
	Total Operators per year	416	Total hrs	$ 75	**$ 31,000**	Two crew, 4 hrs/wk.
Other Costs				Total Other	**$ -**	
			TOTAL ANNUAL O&M COSTS		**$ 138,000**	

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: Phase 3 - Alternative 1 (IPR)

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 16,600,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 37,130,000	
15 - Mechanical	$ 69,000	
16 - Electrical	$ 6,474,000	
17- I&C	$ 3,237,000	

RAW CONSTRUCTION COST		**$ 63,510,000**	
Construction Contingency	20%	$ 12,702,000	
Centralized AWPFexpansion		$ 52,900,000	Adapted from SVAWPC ($46M for 8 mgd)
BASE CONSTRUCTION COST		**$ 129,112,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 38,734,000	
Easements		$ -	
Project Contingency	10%	$ 16,784,600	
Land Acquisition Cost		$ 17,090,000	21 acres of property acquisition needed from District's TM.8C
TOTAL PROJECT COST		**$ 201,720,600**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 16,600,000**	
	Product pipeline	21	in	41,140	LF	$ 16.00	$ 13,823,000	Smaller line to Los Gatos well field
	Hwy x'ings (x1)	21	in	250	LF	$ 30.00	$ 158,000	Trenchless, adapted from District TM.8C
	Rail x'ings (x1)	21	in	100	LF	$ 30.00	$ 63,000	Trenchless, adapted from District TM.8C
	River x/ings (x3)	21	in	750	LF	$ 30.00	$ 473,000	Trenchless, adapted from District TM.8C
	Bore & Jack Pits	-	-	8	EA	$ 91,400.00	$ 731,000	
	Backflush piping	8	in	5,280	LF	$ 16.00	$ 676,000	Based on District's TM.8C
	Laterals to wells	8	in	5,280	LF	$ 16.00	$ 676,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 37,130,000**	
	PWPS expansio	3750	hp	1	EA	$ 2,073	$ 2,575,000	Upgrade to pump to Los Gatos ponds
	Injection wells	-	-	18	EA	$ 1,350,000	$ 24,300,000	Adapted from TM.8C costs w/o contingency
	Transfer PS	750	hp	1	EA	$ 7,329	$ 5,497,000	Transfer 10 mgd to injection wells
	AOP expansion	9.2	mgd	1	LS	$ 4,372,465.26	$ 4,372,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 386,000	

Project: SBWR Strategic and Master Plan

Component: Phase 3 - Alternative 1 (IPR)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

15 - Mechanical							**$ 69,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 69,000	$ 69,000	Based on 9 mgd expansion
16 - Electrical							**$ 6,474,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 6,474,000	AOP, pump stations and wells only
17 - I&C							**$ 3,237,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 3,237,000	Pump stations and wells only
EASEMENT ACQUISITION							**Total Cost**	
	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ -**	
							$ -	
ANNUAL O&M COSTS				**Amount**	**Unit**	**Value**	**Cost**	
Consumables						Total Consumables	**$ 4,502,000**	
	Equipment Consumables			$ 221,159,000		2%	$ 4,423,000	2% of Equipment
	Mechanical Consumables			$ 219,000		2%	$ 4,000	2% of Mechanical
	Instrumentation Consumables			$ 3,757,000		2%	$ 75,000	2% of Instrumentation
Power Costs						Total Power	**$ 10,508,000**	
	AWPF				Horsepower			
					Hours per year operation			
					Annual Cost		$ 5,840,000	Adapted from SVAWPC Engineer's Report
	PWPS				Horsepower	3,750		
					Hours per year operation	8,059		
					Annual Cost		$ 3,377,000	Pumping to Los Gatos Ponds
	Transfer PS				Horsepower	750		
					Hours per year operation	8,059		
					Annual Cost		$ 675,000	Transfer PS for 9.5 mgd to injection wells
	AOP				Horsepower			
					Hours per year operation			
					Annual Cost		$ 616,000	Adapted from similar FAT project.
Chemicals						Total Chemicals	**$ 2,315,000**	
	AWPF Chemicals						$ 2,315,000	Adapted from SVAWPC Engineer's Report
							$ -	+ AOP from similar FAT project
							$ -	
Labor Costs						Total Labor	**$ 1,560,000**	
	Total # Operators			10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator			2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year			20800	Total hrs	$ 75	$ 1,560,000	$75/hr
Other Costs						Total Other	**$ 1,350,000**	
	Recharge Pond O&M						$ -	TBD
	RWF Secondary Effluent						$ -	Assume no cost
	Injection well O&M			18	number	$ 75,000.00	$ 1,350,000	Adapted from similar injection project
					TOTAL ANNUAL O&M COSTS		**$ 20,235,000**	

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: Phase 3 - Alternative 2 (IPR + DPR)

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 1,521,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 12,795,000	
15 - Mechanical	$ 1,638,000	
16 - Electrical	$ 1,638,000	
17- I&C	$ 819,000	

	RAW CONSTRUCTION COST	**$ 18,411,000**	
Construction Contingency	20%	$ 3,682,000	
	Centralized AWPFexpansion	$ 52,900,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 74,993,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 22,498,000	
Easements		$ -	
Project Contingency	10%	$ 9,749,000	
Land Acquisition Cost		$ 814,000	Property acquisition for transfer PS
	TOTAL PROJECT COST	**$ 107,240,000**	based on District's TM.8C

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 1,521,000**	
	Pipeline extensio	36	in	2,640	LF	$ 16.00	$ 1,521,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 12,795,000**	
	PWPS expansio	3000	hp	1	EA	$ 2,246	$ 1,540,000	Upgrade to product water pump station
	Transfer PS	1000	hp	1	EA	$ 6,652	$ 6,652,000	Transfer 9.5 mgd to Central Pipeline
	AOP expansion	9.2	mgd	1	LS	$ 4,372,465.26	$ 4,372,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 231,000	
15 - Mechanical							**$ 1,638,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 69,000	$ 69,000	Based on 9 mgd expansion
	Chlorine tank + pumps + allownaces			1	EA	$ 69,000	$ 69,000	Based on 9 mgd expansion
	Connection vault at Central Pipeline			1	LS	$ 1,500,000	$ 1,500,000	Sr. engineering estimate

Project:	**SBWR Strategic and Master Plan**	Date:	April 1, 2014
		Project Number:	0057-007.02

Component: Phase 3 - Alternative 2 (IPR + DPR)

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd

Estimate Type: Conceptual Planning

			Cost	
16 - Electrical			**$ 1,638,000**	
Electrical Substation			$ -	
Electrical Allowance	20% of Division 11 (Equipment)	20%	$ 1,638,000	Pump stations only
17 - I&C			**$ 819,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$ 819,000	Pump stations only

EASEMENT ACQUISITION						**Total Cost**
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ -**
						$ -

ANNUAL O&M COSTS		**Amount**	**Unit**	**Value**	**Cost**	
Consumables				Total Consumables	**$ 3,999,000**	
	Equipment Consumables	$ 196,824,000		2%	$ 3,936,000	2% of Equipment
	Mechanical Consumables	$ 1,788,000		2%	$ 36,000	2% of Mechanical
	Instrumentation Consumables	$ 1,339,000		2%	$ 27,000	2% of Instrumentation
Power Costs				Total Power	**$ 10,734,000**	
	AWPF		Horsepower			
			Hours per year operation			
			Annual Cost		$ 5,840,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	3,750		
			Hours per year operation	8,059		
			Annual Cost		$ 3,377,000	Pumping to Los Gatos Ponds
	Transfer Pump Station		Horsepower	1,000		
			Hours per year operation	8,059		
			Annual Cost		$ 901,000	Transfer 9.5 mgd to Central Pipeline
	AOP		Horsepower			
			Hours per year operation			
			Annual Cost		$ 616,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 2,491,000**	
	AWPF Chemicals				$2,310,000	Adapted from SVAWPC Engineer's Report
					$ -	+ AOP from similar FAT project
	Chlorine	181,056	gal	$ 1.00	$ 181,000	8 mg/L dose for free chlorine conveyance
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	$ 1,560,000	$75/hr
Other Costs				Total Other	**$ -**	
	Recharge Pond O&M				$ -	TBD
	RWF Secondary Effluent				$ -	Assume no cost
			TOTAL ANNUAL O&M COSTS		**$ 18,784,000**	

Project:	**SBWR Strategic and Master Plan**	Date:	April 1, 2014
		Project Number:	0057-007.02
Component: Phase 3 - Alternative 3 (DPR)			
		Prepared by:	AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ -	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ -	
15 - Mechanical		$ -	
16 - Electrical		$ -	
17- I&C		$ -	
	RAW CONSTRUCTION COST	**$ -**	
Construction Contingency	20%	$ -	
	BASE CONSTRUCTION COST	**$ -**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ -	
Easements		$ -	
Project Contingency	10%	$ -	
Land Acquisition Cost			
	TOTAL PROJECT COST	$ -	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ -**	
							$ -	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
							$ -	
11 - Equipment							**$ -**	
							$ -	
15 - Mechanical							**$ -**	
							$ -	

Project: SBWR Strategic and Master Plan

Component: Phase 3 - Alternative 3 (DPR)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

16 - Electrical			**$ -**
Electrical Substation			$ -
Electrical Allowance	20% of Division 11 (Equipment)	20%	$ -
17 - I&C			**$ -**
I&C Allowance	10% of Division 11 (Equipment)	10%	$ -

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit		Value	Cost	
Consumables					Total Consumables	**$ 3,348,000**	
	Equipment Consumables	$ 164,611,667			2%	$ 3,292,000	2% of Equipment
	Mechanical Consumables	$ -			2%	$ 39,000	2% of Mechanical
	Instrumentation Consumables	$ -			2%	$ 17,000	2% of Instrumentation
Power Costs					Total Power	**$ 10,509,000**	
	AWPF		Horsepower				
			Hours per year operation				
			Annual Cost			$ 5,840,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower		4,500		
			Hours per year operation		8,059		
			Annual Cost			$ 4,053,000	Pumping to Central Pipeline
	AOP		Horsepower				
			Hours per year operation				
			Annual Cost			$ 616,000	Adapted from similar FAT project.
Chemicals					Total Chemicals	**$ 2,872,000**	
	AWPF Chemicals					$ 2,315,000	Adapted from SVAWPC Engineer's Report
						$ -	+ AOP from similar FAT project
	Chlorine	556,509	gal	$	1.00	$ 557,000	8 mg/L dose for free chlorine conveyance
Labor Costs					Total Labor	**$ 1,560,000**	
	Total # Operators	10	number				Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr				average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$	75	$ 1,560,000	$75/hr
Other Costs					Total Other	**$ -**	
	RWF Secondary Effluent					$ -	Assume no cost
			TOTAL ANNUAL O&M COSTS			**$ 18,289,000**	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 3)

Date: April 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ -	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 427,000	
15 - Mechanical	$ -	
16 - Electrical	$ 85,000	
17- I&C	$ 43,000	

	RAW CONSTRUCTION COST		**$ 555,000**
Construction Contingency		20%	$ 111,000
	BASE CONSTRUCTION COST		**$ 666,000**
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 200,000
Easements			$ -
Project Contingency		10%	$ 87,000
Land Acquisition Cost			
	TOTAL PROJECT COST		$ 953,000

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ -**	
							$ -	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 427,000**	
	PS expansion	200	hp	1	EA	$ 5,954	$ 427,000	Pumping to Coyote Point
15 - Mechanical							**$ -**	
							$ -	
16 - Electrical							**$ 85,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 85,000	
17 - I&C							**$ 43,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 43,000	

Project: SBWR Strategic and Master Plan

Date: April 1, 2014
Project Number: 0057-007.02

Component: RO Concentrate Management - Coyote Point Outfall (Phase 3)

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 26,000**	
	Equipment Consumables	$ 1,191,000		2%	$ 24,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$ -	2% of Mechanical
	Instrumentation Consumables	$ 119,000		2%	$ 2,000	2% of Instrumentation
Power Costs				Total Power	**$ 180,000**	
	Pump station		Horsepower	200		
			Hours per year operation	8,059		
			Annual Cost		$ 180,000	Pumping to Coyote Point outfall
Chemicals				Total Chemicals	**$ -**	
					$ -	
					$ -	
					$ -	
Labor Costs				Total Labor	**$ 31,000**	
	Total # Operators	2	number			
	Average Annual Hours per operator	208	hrs/yr			Assume weekly inspection and cleaning.
	Total Operators per year	416	Total hrs	$ 75	**$ 31,000**	Two crew, 4 hrs/wk.
Other Costs				Total Other	**$ -**	
			TOTAL ANNUAL O&M COSTS		**$ 237,000**	

Appendix 8A - Coyote Valley Concepts Study Technical Memorandum

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South Bay Water Recycling
Strategic and Master Planning

Technical Memorandum

Title: **Coyote Valley Concepts Study**
Prepared by: **Jennifer Thompson, CDM Smith**
Marc Nakamoto, RMC
Lindsey Stephenson, CDM Smith
Arthur Goh, CDM Smith
Margie Nellor, NEA
Reviewed by: **Tom Richardson, RMC**
Bruce Chalmers, CDM Smith
Date: **December 16, 2014**
Reference: **Task 3.1.2 Coyote Valley Concepts Study**

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1. Introduction

1.1 TM Purpose

As part of the South Bay Water Recycling (SBWR) Strategic and Master Planning, this Coyote Valley Concepts Study technical memorandum (TM) identifies conceptual-level opportunities to increase recycled water use in the Coyote Valley. The Strategic and Master Planning Report (RMC/CDM Smith, 2014) was completed by the City of San José (City or San José) in partnership with the Santa Clara Valley Water District (SCVWD or District) to evaluate how recycled water produced from the San José/Santa Clara Regional Wastewater Facility (RWF) could be used to meet the Strategic and Master Plan recycled

SCVWD has a goal of expanding recycled water so that it supplies at least 10 percent of countywide water demands. This results in a goal of 40,000 AFY of recycled water use by 2025 and 50,000 AFY of use by 2035. In addition, SCVWD's 2012 Water Supply and Infrastructure Master Plan (WSIMP) calls for a total of 50,000 AFY recycled water by 2035. A baseline county-wide recycled water production of 15,000 AFY was chosen as a starting point, translating into a need to develop an additional 25,000 AFY of recycled water use by 2025 followed by an additional 10,000 AFY by 2035 (to reach a total additional

Table 1-1: Strategic Plan Recycled Water Targets

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: These targets are based on a baseline county-wide recycled water use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand).
Source: SBWR Strategic and Master Planning Report (RMC/CDM Smith, 2014).

While the SCVWD plans to meet its recycled water targets with sources throughout the county, for planning purposes the SBWR master planning targets assume that SCVWD's additional recycled water needs will be met by the RWF. It is assumed that any near- or long-term wastewater flow diversion

This study assesses potable reuse opportunities, both indirect and direct, including delivery of purified water to existing percolation ponds, to surface water pipelines in the area around, or directly to Calero Reservoir. In conjunction with the potable reuse alternatives, interim and synergistic non-potable opportunities to provide an alternative source of water supply (recycled water) to customers currently driver for this study is to provide new drought-proof water supplies, both raw water and non-potable water, for existing surface water customers.

1.2 TM Background

Coyote Valley is a groundwater management area within the Santa Clara Sub-basin. It is located in the southern portion of the county, where development is less dense. Recycled water use in the area would offset customers currently using District surface water from San Felipe project facilities, including the Cinnabar Hills Golf Club and the Coyote Golf Club. Potable reuse projects would offset the need for imported water and provide a drought-proof water supply for the District and its customers. Per the 2005 Water Supply Availability Analysis (WSAA) for the Coyote Valley Specific Plan, this area of the sub-

In 2002, the City and the District executed the Silver Creek Agreement, which is a commitment for the SBWR system to deliver not less than 5 mgd of recycled water plus any unused capacity to the District in the Coyote Valley area. The Silver Creek agreement states that the "District shall maintain the sole right to use the capacity in excess of 10 mgd, and in any event, not less than a total of 5 mgd." As described in Section 8 of the SBWR Strategic and Master Planning Report, the District is considering plans to utilize this water for the Ford Pond groundwater replenishment project. This TM presents options for implementing the Ford Pond groundwater replenishment (GWR) project, providing non-potable water

Any non-potable or potable reuse projects developed in the Coyote Valley area must consider groundwater quality, the shallow depth to groundwater, and the presence of chemicals of emerging Concern (CECs) like N-Nitrosodimethylamine (NDMA), 1,4-dioxane, triclosan, and other trace chemicals. The SCVWD Annual Groundwater Report for Calendar Year 2012 indicated that the Coyote Valley groundwater had a total dissolved solids (TDS) around 360 milligrams per liter (mg/L) and a nitrate concentration around 11 mg/L. These levels are fairly consistent with the previous five years of groundwater quality monitoring data. The SCVWD has developed the Santa Clara Plain (Santa Clara and Coyote Valley Sub-basins) Salt and Nutrient Management Plan (SNMP) was published in November 2014. New irrigation using recycled water in the Coyote Valley is not specifically addressed in the SNMP. Since recycled water has an average TDS concentration of approximately 720 mg/L and based on the low TDS concentration in the basin (see Section 3 below), any groundwater replenishment project using

The District's Water Supply Availability Analysis for the Coyote Valley Specific Plan (April 2005) stated that given the hydrogeology of the Coyote Valley Sub-basin, even when recycled water is intended for irrigation, some of this applied water will work its way to the water table and the principal aquifer. The

District’s recently completed Advanced Treated Recycled Water Feasibility Study concluded that the existing tertiary treated recycled water use in the area could have impacts on Coyote Valley groundwater quality. District staff concluded that recycled water used in Coyote Valley that could percolate into the groundwater sub-basin be fully advanced treated. Also, the aquifer in the north end of Coyote Valley and abutting south end of the Santa Clara plain rated the highest risk in the District's Groundwater Vulnerability study The District staff also concluded that advanced oxidation was needed

1.3 TM Organization

This TM is organized as follows:

1. Introduction (this section)
2. Coyote Valley Recycled Water Concept
3. System and Regulatory Considerations
4. Non-Potable Reuse Opportunities
5. Potable Reuse Opportunities

2. Coyote Valley Reuse Concept

Through the SBWR Strategic and Master Planning project development, the Ford Pond GWR project has been identified and selected as the preferred near-term potable reuse project. Using this project as a basis for this investigation, the following near-term and long-term concepts are proposed for expanding

System and regulatory considerations that must be taken into account for Coyote Valley reuse concepts are discussed further in Section 3, including the recommendations of the 2014 Groundwater Management Plan and the 2014 Salt and Nutrient Management Plan that also need to be considered. The non-potable and potable reuse concepts are discussed in more detail in Sections 4 and 5,

Table 2-1 provides the definitions for the near-term and long term project concepts defined in the Strategic and Master Planning Report.

Table 2-1: Strategic Plan Project Time Frame

Project	Year
Near-Term	2015-2020
Long-Term	After 2020

2.1 Near-Term Concepts

The near-term concept for Coyote Valley includes both potable and non-potable reuse projects. The near-term concept would rely on the minimum of 5 mgd of SBWR recycled water identified in the Silver Creek Agreement as the source water for the project

Potable Reuse

The near-term potable reuse project is the Ford Pond GWR project identified in the Strategic and Master Planning Report, which would be located just north of the Coyote Valley. The Coyote Valley potable reuse opportunities build upon the Ford Pond GWR project. The project would include a satellite advanced water purification facility (AWPF) to produce purified recycled water with microfiltration (MF), reverse osmosis (RO), and advanced oxidation (AOP). The AOP process used in all of the currently permitted IPR projects use ultraviolet light and hydrogen peroxide (UV/peroxide). The District is

The AWPF would treat a minimum of 5 mgd of SBWR recycled water to produce an estimated 4,200 acre-feet per year (AFY) of purified recycled water. The water would be recharged at the existing and expanded Ford Pond or at new ponds in an area in the vicinity of the Ford Pond

Non-Potable Reuse

For the non-potable reuse concept, a limited system could be implemented in Coyote Valley as part of the Ford Pond project to serve recycled water to the Cinnabar Hills Golf Club, the Coyote Golf Club, and potentially to some local agricultural customers. Due to the TDS concerns in the Coyote Valley groundwater basin, the water served from this system would be a blend of purified recycled water from the Ford Pond AWPF and SBWR tertiary recycled water to provide water with an average TDS in the

2.2 Long-Term Concepts

Due to limited growth and limited non-potable recycled water opportunities in the Coyote Valley, the long-term concepts focus on expanding potable reuse. The long-term potable reuse concept opportunities include direct potable reuse into the Cross Valley Pipeline and reservoir augmentation at the Calero Reservoir. The pipeline implemented for the near-term non-potable customers could be

Due to this potential repurposing, non-potable customers who were originally served by the pipeline could either be served purified recycled water (an expensive and over-treated supply), or switched to an alternative water supply, such as surface water. As this concept is further developed, these non-potable

3. System and Regulatory Considerations

To implement potable and non-potable reuse projects in Coyote Valley, there are several system and regulatory limitations that must be considered, including the following:

- Recycled water supply and recharge capacities
- Water quality requirements and assumptions
- Treatment and discharge limitations for RO concentrate disposal

These limitations are investigated in this TM for the purpose of developing conceptual-level concepts, but are not meant to be an exhaustive list of constraints. Other limitations and constraints would include land acquisition and land rights to accommodate land access needs for the recycled water facilities, such as the AWPF location; new or expanded recharge ponds; and related appurtenances such as conveyance pipelines, water storage, and electrical substations. These issues have been identified in the Strategic and Master Planning Report and would be investigated as part of follow-on Technical

Impacts to other District facilities and operations as part of a detailed reoperations study, which would address topics such as the use of imported water from the Cross Valley pipeline, flows to the surface water treatment plants, operation of local storage reservoirs, impacts to recharge operations and water accounting, and impacts to the District's water rights would need to be investigated in more detail as

3.1 Recycled Water Supply and Recharge Capacities

In 2002, the City and the District executed the Silver Creek Agreement, which is a commitment for the SBWR system to deliver a minimum of 5 mgd to the District in the area near the existing Metcalf Energy Center (MEC) In addition, the original planning of the SBWR system accounted for an additional 5 mgd of non-potable reuse in the Coyote Valley area. Although the SBWR Strategic and Master Plan Report does not plan for this additional 5 mgd in Coyote Valley, improvements to the SBWR system could be

The Strategic and Master Planning Report assumes that the minimum of 5 mgd of water identified in the Silver Creek Agreement would be delivered at a constant flow rate, though additional NPR storage or AWPF equalization could provide added operational flexibility. As a basis for this level of planning, it is assumed that the additional 5 mgd of SBWR recycled water would also be delivered at a constant flow rate. Recycled water supply delivery strategy and pricing would have to be agreed upon by the City and

As part of the SBWR Strategic and Master Planning, SBWR system modeling was completed to assess the improvements needed to the SBWR system to deliver the first increment of 5 mgd. This flow can be delivered to the Ford Pond satellite AWPF location with the improvements proposed in the near-term non-potable capital improvements. The near-term and long-term non-potable system improvements are described in the SBWR Strategic and Master Planning Report.

Additional SBWR system hydraulic modeling was completed for the second increment of 5 mgd. The modeling results show that the additional 5 mgd of recycled water can be delivered to the area of the Ford Pond satellite AWPF through Zone 3 assuming that all of the near-term non-potable capital improvements are implemented (see Section 10 of the SBWR Strategic and Master Planning Report). Additionally, Pump Station 11 would have to be upgraded to achieve a flow of 12,800 gpm at a head of

Alternatively, a new pipeline could be installed along Monterey Road/Bernal Road to avoid pumping through Zone 3 and breaking pressure, which has increased energy requirements. These options are discussed further in Section 4 below.

3.2 Water Quality Requirements and Assumptions

This section describes the water quality requirements and assumptions for potable and non-potable reuse in Coyote Valley. The requirements and assumptions are presented for groundwater quality for the Ford Pond GWR project as wells as for non-potable reuse in Coyote Valley. Requirements and assumptions for potential groundwater recharge in the Coyote Valley Sub-basin, reservoir augmentation

Groundwater Quality Requirements for the Ford Pond GWR and Non-Potable Reuse

Groundwater quality must be addressed for both groundwater replenishment and non-potable reuse, since both types of projects could impact the groundwater. For groundwater replenishment, the groundwater replenishment permit regulations and the local basin plans such as the Santa Clara Sub-basin SNMP and the WSAA will dictate the water quality recommendations and requirements. For non-potable reuse, water quality will be governed by the Title 22 permit requirements and the local basin

The Ford Pond GWR project and non-potable reuse in Coyote Valley must be developed with the processes and facilities necessary to protect the groundwater quality, specifically TDS. The Coyote Valley overlies the Santa Clara Sub-basin, which is further divided in to the Santa Clara Plain and the Coyote Valley sub-basins. The Ford Pond GWR project would recharge the Santa Clara Plain recharge area sub-basin while the non-potable demands would be served in the Coyote Valley over the Coyote Valley recharge area sub-basin. TDS in the Santa Clara Sub-basin is typically in the range of 200 to 500 mg/L with a median of TDS of 400 mg/L. Higher TDS concentrations exist closer to the San Francisco Bay and

The San Francisco Basin Plan establishes groundwater objectives for salts, which are 500 mg/L for TDS, 250 mg/L for chloride, and 250 mg/L for sulfate (see Section 6.2 of the SBWR Strategic and Master Planning Report). Additionally, the District is working with local stakeholders and regulators to develop a

Salt and Nutrient Management Plan for the Santa Clara Sub-basin, which includes Coyote Valley, to address regional salt and nutrient loading to groundwater from all sources, including recycled water and agricultural activity. The SNMP was finalized in November 2014 and includes implementation measures that will further guide the use of recycled water in the Santa Clara Sub-basin. The District is highly protective of groundwater quality and desires to maintain the current groundwater quality. The average TDS for the Coyote Valley Sub-basin is 377 mg/L and it is expected to decrease over time. In 2012, the TDS concentrations ranged from 236 mg/L to 630 mg/L. The assimilative capacity of the Coyote Valley

While the groundwater does not exceed the water quality objectives for the basin (500 mg/L) and no mitigation measures are required, the District and stakeholders have historically implemented water quality management initiatives to maintain the high quality of the groundwater in the area. Therefore, any GWR or recycled water projects developed in the area could require TDS removal to achieve a TDS concentration of approximately less than 500 mg/L, depending on whether the assimilative capacity can be used or not. At a minimum, it is assumed that partial RO treatment will be required for both the

To meet the new groundwater replenishment regulations, the Ford Pond GWR project must also meet quality requirements for total organic carbon (TOC) and total nitrogen (TN). The TOC will dictate the recycled municipal wastewater contribution (RWC) for the project. At this time, it is planned that for the Ford Pond GWR project would recharge SBWR recycled water treated with full advanced treatment (MF, RO, and AOP). While this level of treatment is not required for surface application, full advanced treatment was selected to minimize diluent water requirements, the required recharge area, and the

Non-potable reuse must meet Title 22 requirement for recycled water quality. The SBWR recycled water currently complies with these requirements. The TDS of the SBWR recycled water would have to be reduced before it is used in Coyote Valley however. The City and the District started operation of the Silicon Valley Advanced Water Purification Center (SVAWPC) in 2014 to reduce the TDS of the SBWR recycled water from approximately 720 mg/L to 500-600 mg/L. Before the water is used the Coyote Valley, the TDS may have to be reduced to approximately 350 mg/L to be below the average TDS in the basin and not impact the current water quality. This can be achieved by blending purified recycled water

Groundwater Recharge in Coyote Valley Sub-basin Area

One potential future option for reuse in Coyote Valley (should substantial development occur in the valley) is groundwater recharge in the Coyote Valley recharge area sub-basin, as is being proposed via the Ford Pond for the Santa Clara Plain groundwater sub-basin, requiring detailed groundwater computer modeling to establish the viability of this recharge concept. At this time, there are no plans for significant development in the Coyote Valley. Therefore, this potential future concept is not considered further in this study

Reservoir Augmentation

Another concept for potable reuse in the Coyote Valley recharge area is to use the Calero Reservoir for indirect potable reuse (IPR). Per Senate Bill (SB) 918, the California State Division of Drinking Water (DDW) has a statutory deadline to adopt uniform water recycling criteria for surface augmentation by December 31, 2016. DDW has been working on an internal draft of the regulations, but has provided no

To date, only the City of San Diego is actively considering the use of highly purified recycled water (MF, RO, and UV/peroxide) for reservoir augmentation and has been working with DDW and the San Diego Regional Water Quality Control Board (RWQCB) to determine permit requirements. San Diego has received the support of both the San Diego RWQCB and DDW for the project. Given the successful approval of the San Diego project approach and in the absence of adopted regulations from DDW, the approach for DDW approval for an SBWR reservoir augmentation project would likely follow the San Diego project model contingent upon any input from the SB 918 expert panel and advisory group. In the absence of specific water quality requirements developed by state agencies at this time, it is reasonable

- Compliance with all federal and state drinking water maximum contaminant levels (MCLs) and secondary MCLs;
- Remaining below all DDW notification levels (NLs);
- Compliance with all requirements of DDW's IPR regulations for Groundwater Replenishment – Subsurface Application (Title 22 Division 4 Article 5.2). These requirements were used for the WPDP because DDW has not issued draft regulations for surface water augmentation.
- Compliance with all established discharge requirements from the RWQCB, including Basin Plan Objectives, California Toxics Rule (CTR) requirements for freshwater and for human health, and

The San Diego WPDP project is based on using full advanced treatment for reservoir augmentation. While it may be possible to use an alternative treatment for reservoir augmentation as long as the quality requirements are met, it is assumed for this evaluation that full advanced treatment would be required. It is unknown if the DDW will include a TOC requirement for reservoir augmentation; if it does,

The discharge of the recycled water into the San Vicente Reservoir in San Diego was also modeled extensively using a three-dimensional hydrodynamic model to determine the potential impacts on the reservoir water quality and to prove that the reservoir could act as an environmental buffer capable of providing adequate retention time and blending of the purified water. The modeling in San Diego showed that the San Vicente reservoir had sufficient storage capacity and stratification to accommodate the purified water flows throughout the year as well as showing blending of the purified water with other raw water sources. Natural stratification and mixing of the reservoir can be important because it determines the extent and seasonal timing of mixing and retention time provided by the reservoir. Water quality modeling focused on algae growth which could impact the reservoir's use as a potable

Reservoir augmentation and stream flow augmentation are discussed further in an appendix of the SBWR Strategic and Master Planning Report, which includes a detailed discussion of the City of San Diego project

Direct Potable Reuse

At this time there are no direct potable reuse projects permitted in California. There are existing direct potable reuse projects outside of California such as the one currently operating in Big Spring Texas. California's Senate Bills 322 and 918 require the DDW, in consultation with the State Water Resources Control Board (SWRCB), to investigate and report to the Legislature by the end of December 2016 on the feasibility of developing uniform criteria for direct potable reuse. While the quality requirements have

There is ongoing research related to direct potable reuse, including bench-scale and pilot-scale testing to assess the equivalency of advanced treatment trains that may prove the feasibility of using alternative treatments, such as ozone with biologically activated carbon (BAC), for direct potable reuse. Information on direct potable reuse within California and outside of California is included in Sections 6.2.3 and 6.2.4, respectively, of the SBWR Strategic and Master Planning Report. Ozone-BAC is used in Georgia (Lake Lanier) for indirect potable reuse/reservoir augmentation and can be used in place of FAT

The Cross Valley Pipeline currently provides imported water to the Calero Reservoir. The Cross Valley Pipeline comes into a vault before the Calero Reservoir. It has one pipe that can discharge into the reservoir (Bailey Turnout) and a separate pipe that starts from this vault and takes this high-head water and conveys the water to the Almaden Pipeline. Water from the Cross Valley pipeline can therefore bypass the Calero Reservoir and preserve the head that allows direct delivery of Central Valley Pipeline (CVP) water from the San Luis Reservoir to the Santa Teresa Water Treatment Plant via the Almaden Pipeline. The Almaden Pipeline also supplies water to the Riconada Water Treatment Plant through the

The approach for direct potable reuse will need to consider these uses for the water, and work with the regulatory agencies to determine if the water quality requirements are different based on these end uses. For example, nutrient requirements for TN and phosphorus might be lower for creek discharge than would be required for drinking water applications.

In absence of the direct potable reuse criteria and need for completed research regarding the suitability of alternative treatment technologies for direct potable reuse, it is assumed that full advanced treatment plus an additional disinfection step would be necessary for direct potable reuse in California

3.3 Treatment and Discharge Limitations for Brine Disposal

As part of the SBWR Strategic and Master Planning project development, the City has conceptually agreed to consider accepting the brine from the 5 mgd satellite AWPF for the Ford Pond GWR project, pending additional review as the concept is progressed into design. The brine would be discharged into the existing sewer system in the area of Monterey Road and Flintwell Way, which would require about a 0.5-mile pipeline from the AWPF (tentative location on vacant land on Great Oaks Boulevard). The District would need to work with the City to obtain an industrial discharge permit for the MF backwash and RO concentrate disposal into the sewer and pay the appropriate fees. As part of the next steps for the Ford Pond GWR project, the District will be coordinating with the City of San José for all discharge

The City has concerns with accepting AWPF residuals in its collection system feeding the RWF. This would include an expansion of the Ford Pond project above 5 mgd. The primary concern associated with increased RO concentrate and other AWPF residuals discharged to the sewer is the impact on the chronic toxicity requirements of the RWF effluent. The impact of a higher TDS wastewater on the SVAWPC operation and the SBWR water quality is also a concern for the District and the City. The District's 2014 SNMP also warns of potential increased groundwater TDS impacts from sewer pipe leakage (exfiltration) for the sewer that carries AWPF concentrate discharges that increase the TDS concentration in the sewer. A regional RO concentrate management initiative is anticipated for the future which might alleviate some of these concerns. In the meantime, brine minimization treatment

As described in Section 3.2, to expand potable reuse in Coyote Valley in the near-term, it is highly likely that full advanced treatment (MF, RO, and advanced oxidation) would be required. If the potable reuse expansion was sought in the long-term, then it may be acceptable to utilize an alternative treatment technology that produces a waste stream with a lower or no increased TDS concentration, such as high recovery RO, zero liquid discharge (ZLD), or ozone-BAC (biological activated carbon). These treatment processes and their impact on brine production are discussed in more detail in the Strategic and Master

4. Non-Potable Reuse Opportunities

Previous Coyote Valley studies (circa 2001) identified roughly 2,100 acres of irrigated agricultural land that could potentially use recycled water with about 4,700 acre feet per year of annual use and a summer demand of 10 mgd (Montgomery Watson, March 2001). This section considers the non-potable reuse (NPR) opportunities in the northern portion of Coyote Valley in the vicinity of the Cinnabar Hills Golf Club and Coyote Valley Golf Club. The two golf clubs are the primary customer targets. Agricultural uses along the pipelines could provide additional opportunities, though this would reduce the amount of water available for groundwater replenishment. This conceptual evaluation assumes the demands noted

The existing SBWR distribution system currently ends at the Metcalf Energy Center (MEC) (existing 30-inch pipeline) and service to Coyote Valley south of the MEC would include new pipelines south along Monterey Road. The existing 30-inch pipeline has an estimated capacity of about 15.9 mgd assuming the 5 fps velocity criteria. The MEC and other existing customers on Hellyer Ave and in the nearby vicinity are currently serviced from Zone 3 through a pressure reducing valve to provide the desired operational

For the purpose of this TM, it is assumed that the non-potable demands in Coyote Valley are 2,000 AFY for MEC and 350 AFY for each golf club (Cinnabar Hills and Coyote).

4.1 Recycled Water Delivery Options

The Coyote Valley Golf Club would be connected to the SBWR non-potable recycled water system by continuing the Monterey Highway pipeline past Bailey and Laguna Avenues to the course. The Cinnabar Hills Golf Club would be connected to the SBWR system by constructing a pipeline branch from the Monterey Highway extension down Laguna Avenue and over the hills to the golf course. A pump station

By extending the existing system beyond the MEC, it is assumed that the same water would be served to the MEC and the two golf courses. As discussed in Section 3.2, any non-potable water served in Coyote Valley would require TDS reduction by blending SBWR recycled water and purified recycled water. Serving the TDS-reduced water to the MEC in addition to the golf courses would reduce the quantity of water available for groundwater replenishment in the Ford Pond area. To continue serving SBWR recycled water to the MEC, a separate pipeline could be plumbed from the Ford AWPF to the golf

Two concept options were identified for recycled water delivery through the SBWR system to Coyote Valley. Option 1 (see Figure 4-1) relies on the existing pipeline infrastructure from Zone 3 to convey water to the area south of the MEC. Option 2 (see Figure 4-2) proposes to serve water to the Coyote

Valley area from Zone 2 by constructing a new pipeline in Senter Road and Monterey Highway. Option 2 assumes the Yerba Buena Zone 1 Storage Project is implemented.

Option 1 – Zone 3 Supply

As shown in Figure 4-1, Option 1 would deliver additional supply to Coyote Valley from Zone 3. The total envisioned demand of about 15 mgd (existing 5 mgd, 5mgd Ford Pond IPR, and 5 mgd Coyote Valley) would impact the operation of the existing Pump Station 8 and 11 arrangement because of the new flow and head requirements. Therefore, a renovation of pump station 11 (PS11) for both flow and total dynamic head (TDH) capacity is envisioned. Upgrades would also include a suction pipeline directly from

Table 4-2: Option 1 Infrastructure Summary

Element	Components	Quantity
Zone 3 Service	PS 11 Upgrade	15 MGD
Cinnabar Hills Golf Club	24-inch pipeline 12-inch pipeline New Pump Station	17,000 LF 4,500 LF
Coyote Golf Club	12-inch pipeline	8,500 LF

Option 2 – Zone 2 Supply

Option 2 assumes implementation of the Yerba Buena Zone 1 reservoir project and reconfiguration to Zone 1 and Zone 2 infrastructure. This option would include a new 30-inch recycled water pipeline in Senter Road and Monterey Highway from the Senter Road/Sylvandale Avenue intersection (30-inch Zone 2 pipeline) to the existing pipeline at the Bernal Road /Monterey Highway intersection (See Figure

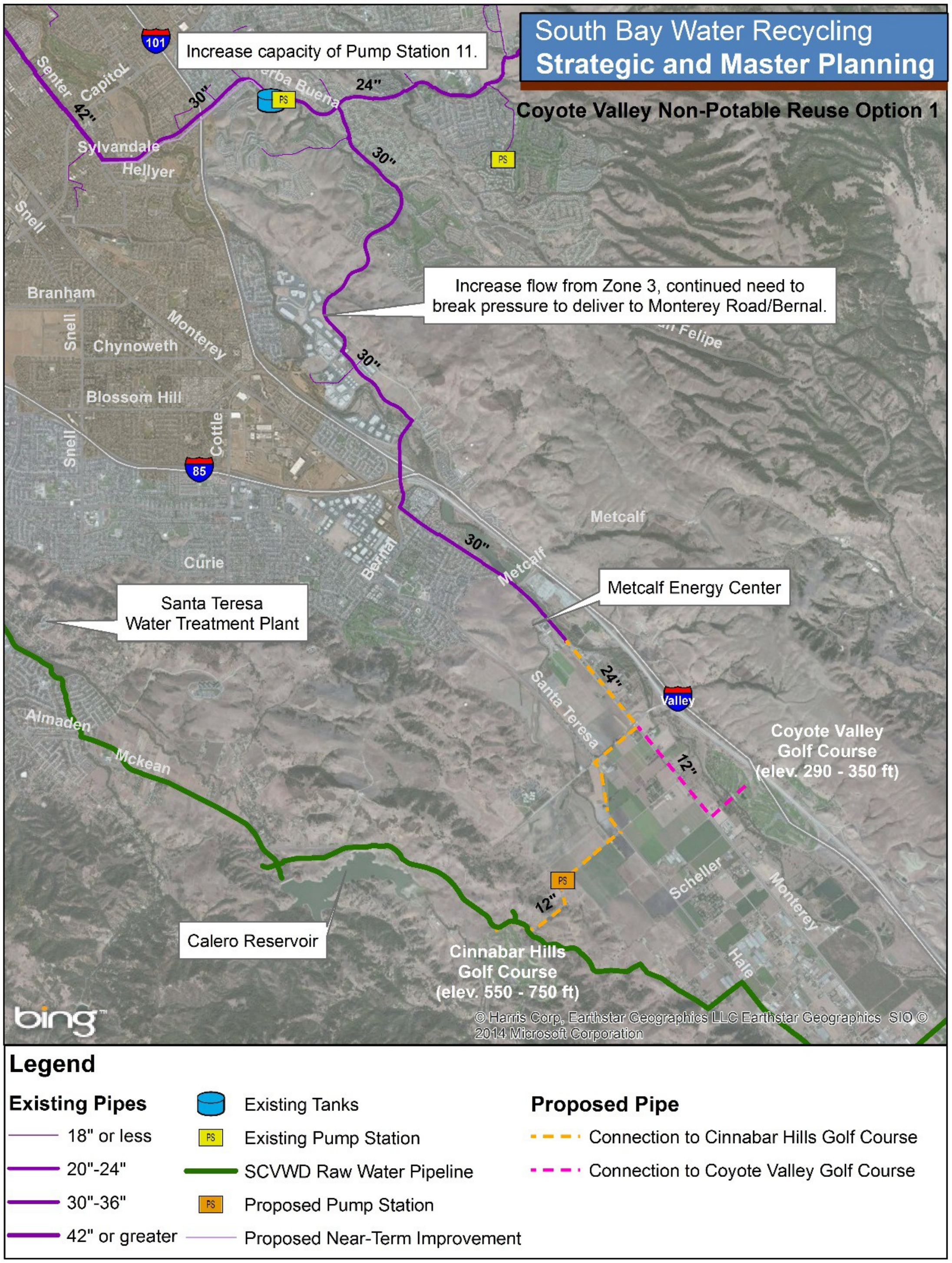
Connecting to Zone 2 would reduce the need to pump to Zone 3 and then reduce pressure for delivery to the existing Bernal Road /Monterey Highway area. Pump Station 8 (Zone 2 pump station) would be replaced for this option to increase capacity and TDH. This option would enhance the capacity of the SBWR system and SBWR system reliability, as it would provide two paths for recycled water to be delivered from Yerba Buena Reservoir to the Coyote Valley area (i.e. down the new Monterey Road

Table 4-3: Option 2 Infrastructure Summary

Element	Components	Quantity
Zone 2 Connection (Senter Road and Monterey Highway Pipeline)	30-inch pipeline PS 8 Upgrade	27,000 LF 15 MGD
Cinnabar Hills Golf Club	24-inch pipeline 12-inch pipeline New Pump Station	17,000 LF 4,500 LF
Coyote Golf Club	12-inch pipeline	8,500 LF

Notes: Assumes Yerba Buena Zone 1 Storage Project and system enhancement is undertaken.

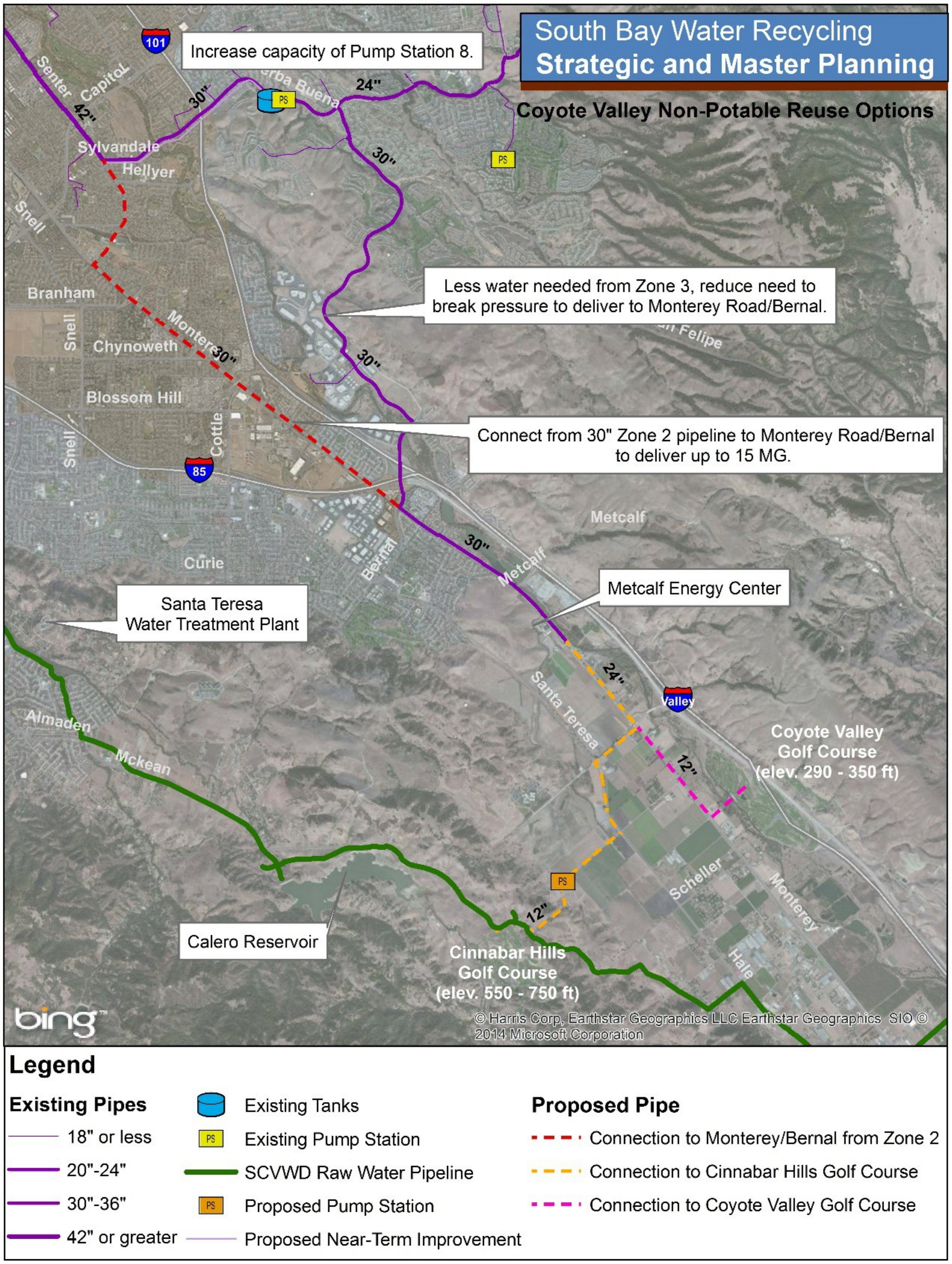
Figure 4-1: Option 1 Coyote Valley from Existing Zone 3


South Bay Water Recycling
Strategic and Master Planning
Coyote Valley Non-Potable Reuse Option 1
101
Increase capacity of Pump Station 11.
Senter
Capitol
42"
30"
Yerba Buena
24"
PS
Sylvandale
Hellyer
30"
Snell
Branham
Increase flow from Zone 3, continued need to break pressure to deliver to Monterey Road/Bernal.
San Felipe
Snell
Chynoweth
Monterey
30"
Blossom Hill
Snell
Cottle
85
Metcalf
Curie
Bernal
30"
Metcalf
Metcalf Energy Center
Santa Teresa Water Treatment Plant
24"
Valley
Santa Teresa
Almaden
12"
Coyote Valley Golf Course (elev. 290 - 350 ft)
Mckean
PS
Scheller
12"
Monterey
Calero Reservoir
Cinnabar Hills Golf Course (elev. 550 - 750 ft)
Hale
bing
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2014 Microsoft Corporation
Legend
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
SCVWD Raw Water Pipeline
Proposed Pump Station
Proposed Near-Term Improvement
Proposed Pipe
Connection to Cinnabar Hills Golf Course
Connection to Coyote Valley Golf Course

Notes:

1. *Alignment to Cinnabar Hills Golf Club based on Ruth and Going, Inc, 4/20/11 RW Extension Drawing.*
2. *Cinnabar Hills Golf Club is assumed to have on site irrigation booster pump stations to accommodate irrigation needs.*

Figure 4-2: Option 2 Coyote Valley from Zone 2


South Bay Water Recycling
Strategic and Master Planning
Coyote Valley Non-Potable Reuse Options
Increase capacity of Pump Station 8.
Less water needed from Zone 3, reduce need to break pressure to deliver to Monterey Road/Bernal.
Connect from 30" Zone 2 pipeline to Monterey Road/Bernal to deliver up to 15 MG.
Metcalf Energy Center
Santa Teresa Water Treatment Plant
Calero Reservoir
Cinnabar Hills Golf Course (elev. 550 - 750 ft)
Coyote Valley Golf Course (elev. 290 - 350 ft)
101
85
Valley
Senter
Capitol
Sylvandale
Hellyer
Snell
Branham
Chynoweth
Blossom Hill
Cottle
Monterey
Yerba Buena
San Felipe
Metcalf
Curie
Bernal
Santa Teresa
Almaden
Mckean
Scheller
Hale
42"
30"
24"
12"
PS
bing
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2014 Microsoft Corporation
Legend
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
SCVWD Raw Water Pipeline
Proposed Pump Station
Proposed Near-Term Improvement
Proposed Pipe
Connection to Monterey/Bernal from Zone 2
Connection to Cinnabar Hills Golf Course
Connection to Coyote Valley Golf Course

Notes:

1. *Alignment to Cinnabar Hills Golf Club based on Ruth and Going, Inc, 4/20/11 RW Extension Drawing.*
2. *Cinnabar Hills Golf Club is assumed to have on site irrigation booster pump stations to accommodate irrigation needs.*
3. *Assumes Yerba Buena Zone 1 Storage Project and system enhancement is undertaken.*

4.2 Recycled Water Delivery Options Comparison

Table 4-4 provides a comparison of the two options. Cost estimates for the two NPR options are shown in Section 6, Table 6-2. Option 1 has a lower capital cost but a higher operation and maintenance (O&M) cost due to energy consumption as all flow is pumped through Zone 3. Option 2 saves energy by providing the necessary SBWR system pressure without necessitating pressure reduction from the higher zone. Option 2 has a significantly higher capital costs but provides additional reliability between

Table 4-4: Options 1 and 2 Comparison Summary

Option 1 Service from Existing Zone 3	Option 2 Service from Zone 2 (New Pipeline)
Use existing infrastructure from Zone 3	New 30-inch connection from Zone 2 to Monterey Highway/Bernal
Replace/Renovate Pump Station 11	Replace/Renovate Pump Station 8
24-inch to 12-inch Cinnabar Hills Golf Club extension, additional pump station needed	24-inch to 12-inch Cinnabar Hills Golf Club extension, additional pump station needed
Possibility of eventual raw water augmentation to SCVWD raw water pipeline	Possibility of eventual raw water augmentation to SCVWD raw water pipeline
12-inch Coyote Golf Club extension	12-inch Coyote Golf Club extension
Opportunity for Ag. Customers along routes	Opportunity for Ag. Customers along routes

4.3 Non-Potable Reuse Pipeline Conversion to Raw Water Augmentation

As described previously, if raw water augmentation to the SCVWD raw water pipeline is selected as a direct potable reuse option, the Cinnabar Hills Golf Club pipeline could be repurposed to add recycled water into the raw water system. To facilitate this option in the future, the 12-inch segment from the end of Laguna Ave to Cinnabar Hills could be increased in size to 24-inch as part of the NPR implementation. This would require about 4,500 ft of pipeline to be upsized. A pump station would also be necessary to increase the purified water pressure to convey it into the Cross Valley Pipeline. The

5. Potable Reuse Opportunities

The potable reuse opportunities in Coyote Valley include direct potable reuse in the Cross Valley Pipeline and reservoir augmentation in Calero Reservoir. Based on the near-term potable reuse recommendations from the SBWR Strategic and Master Planning Report, the District will be pursuing a 5 mgd groundwater replenishment project in the area of the Ford Pond, just north of Coyote Valley. The

As described in Section 2, the concept is that the District would implement the Ford Pond GWR project and serve selected non-potable reuse customers in Coyote Valley, and then consider adding in the future additional potable reuse either with direct potable reuse in the Cross Valley Pipeline or reservoir augmentation in Calero Reservoir. This section includes an overview of the Ford Pond GWR project since this project would become the basis for future potable reuse projects, and discusses the two potable reuse opportunities: direct potable reuse in the Cross Valley Pipeline and reservoir augmentation in

5.1 Ford Pond GWR (Near-Term Project)

The Ford Pond GWR project was identified as part of the SBWR Strategic and Master Planning as a potential near-term potable reuse project. The initial planning for the project is for 4,200 AFY of groundwater recharge based on treating a minimum of 5 mgd of SBWR recycled water with MF, RO, and AOP. The ultimate capacity of the Ford Pond GWR project would be confirmed by groundwater modeling. This project would be located north of Coyote Valley and the Coyote Valley potable reuse

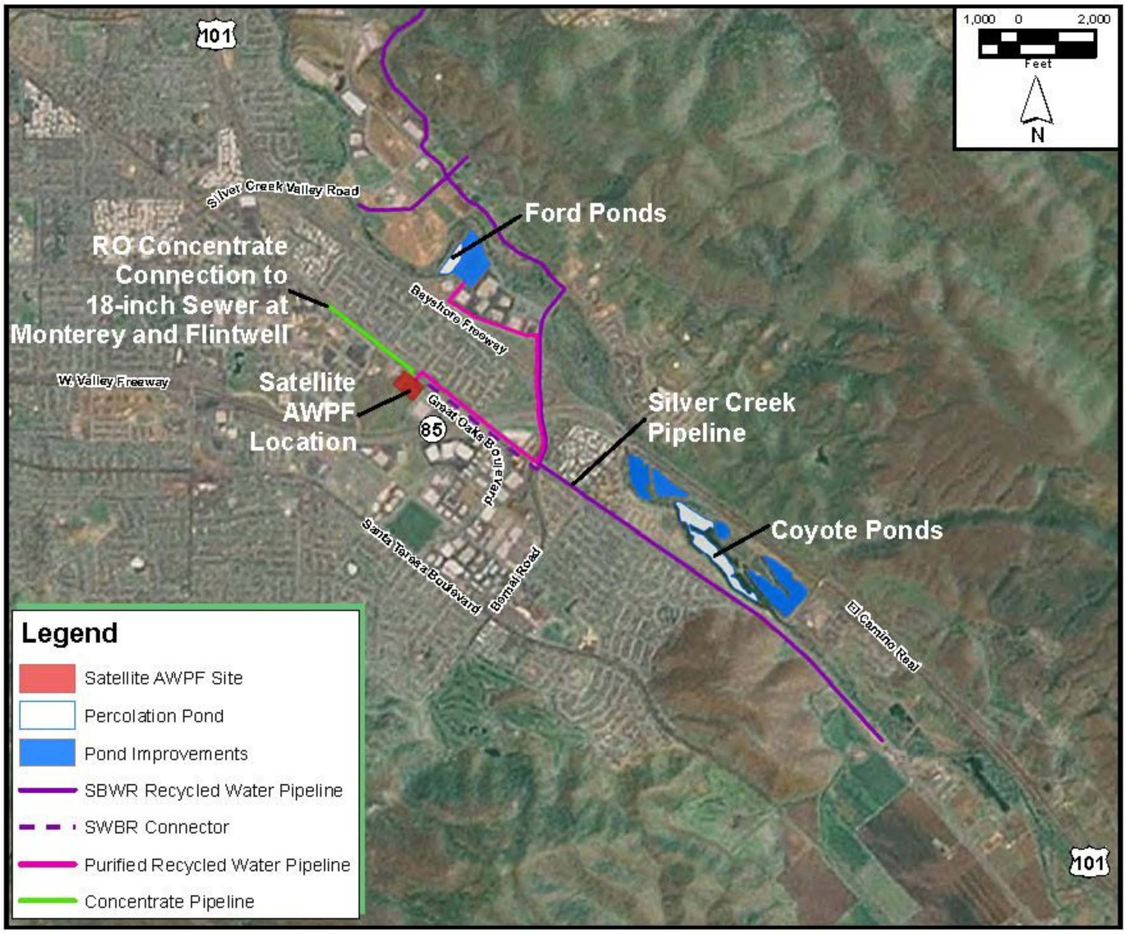
The ne–r-term Ford Pond project would involve the construction of a satellite AWPF in the area of the Ford Pond, and treating SBWR recycled water with full advanced treatment before recharge at the existing Ford Pond and expanded ponds (or ponds in a separate location). It is assumed that the AWPF would be located on vacant land on Great Oaks Boulevard. Based on an estimated AWPF recovery rate of 80 percent (MF recovery of 94 percent and RO recovery of 85 percent) and AWPF annual online factor (94 percent), the potential yield for this option would be approximately 4,200 AFY. The MF backwash waste and RO concentrate would be discharged to the nearby sanitary sewer to be returned to the RWF for treatment. As part of the next-steps on the project, the District and the City will coordinate for

The project elements are shown in Figure 5-1. The near-term Ford Pond project includes the following preliminary infrastructure requirements:

- Connection to existing SBWR distribution system
- A satellite AWPF with 4-mgd production capacity
- Product water pumpstation

- Approximately 0.7 miles of 14-inch pipeline and easements to deliver source water from the Silver Creek Pipeline to the satellite AWPF
- Approximately 1.8 miles of 14-inch pipeline and easements to deliver product water to the Ford Pond for recharge
- Approximately 0.5 miles of 8-inch pipeline and easements to convey RO concentrate and other treatment plant waste from the satellite AWPF to the existing sewer system at Monterey Road and Flintwell Way
- Assuming a recharge capacity of 1 to 2 cubic feet per second (cfs) for the existing 4-acre Ford Road pond, an additional area of up to 15 acres would be needed adjacent to the existing off-

Figure 5-1: Ford Pond GWR Project



Assumed Recharge Rates

Historical recharge at the Ford Pond shows that the historical average is higher than the 1–2 cfs used to conservatively estimate the pond size for this concept. In 1996, the average recharge rate was approximately 8 cfs, declining to about 3 cfs in 1998, highlighting the need for frequent maintenance to maintain higher recharge rates. Site geotechnical studies and groundwater modeling will be required to refine the recharge rate that could be expected from a set of new and existing Ford Pond

Facility Siting

It is assumed that the Ford Pond AWPF would be on a vacant parcel of land on Great Oaks Boulevard. This site was identified in the District's preliminary evaluations. An alternative site for the AWPF could

The vacant parcel of land on Great Oaks Boulevard is large enough that it could potentially also be used for the percolation ponds, if the area has adequate groundwater percolation capabilities. A pond location that provides a greater separation with Coyote Creek could be beneficial to reduce the potential leakage of recycled water from the ponds into Coyote Creek. If leakage into the creek occurs, then a NPDES permit would be required. It might also be possible to construct the new ponds near the

A more detailed siting study would be required to identify alternative site locations and evaluate which specific site is best to locate the AWPF and spreading basins for the project. The siting issues are not considered to have a significant impact on project cost estimates so siting decisions can be delayed until groundwater modeling and a siting study can be performed. These types of issues for the near-term

5.2 Ford Pond GWR with Cinnabar Hills NPR Extension (Near-Term Project)

The Ford Pond GWR project with a pipeline to the Cinnabar Hills Golf Club is a conceptual opportunity to extend recycled water use into the Coyote Valley. As discussed in Section 2, a limited NPR system could be implemented in Coyote Valley to serve recycled water to the Cinnabar Golf Club, the Coyote Golf Club, and potentially some agricultural customers so that these demands could be removed from the District's surface water supply. Due to the TDS concerns in the Coyote Valley Sub-basin, however, the water served from this initial NPR system would have to be a blend of purified recycled water and tertiary recycled water to provide water with an average TDS of approximately 300 - 350 mg/L. This means that some of the water produced at the Ford Pond GWR project satellite AWPF would be used for non-potable reuse (such as golf course irrigation or agriculture) and would reduce the amount of water

Recommendations for the assimilative capacity of the groundwater basin are provided in the District's SNMP. For a typical case, assuming that the TDS of the SBWR recycled water is about 500 mg/L, then about one-third of the NPR volume would have to be supplied by the AWPF to reduce the TDS to the levels recommended in the SNMP. Using the assumed 2,700 AFY demand established in Section 4, about 900 AFY of purified recycled water would be required to obtain the required TDS for irrigation purposes. If only the golf clubs were served the lower TDS water, then about 250 AFY of purified assumed demand of 700 AFY. The amount of purified recycled water used for non-potable reuse would vary through the year: more would be required in summer to meet the peak summer demand and less in winter. Therefore, a higher amount of purified recycled water would be used to help meet the NPR demand in the summer while most of the groundwater replenishment at the Ford Pond would be in the

The NPR pipeline extension could be added to the Ford Pond near-term potable reuse project to serve lower TDS recycled water to the Cinnabar Hills Golf Club and other nearby agricultural customers. This pipeline extension would parallel the existing 30-inch diameter Silver Creek pipeline to the MEC. It is proposed that the pipeline be separate from the SBWR system so that the TDS reduction provided by

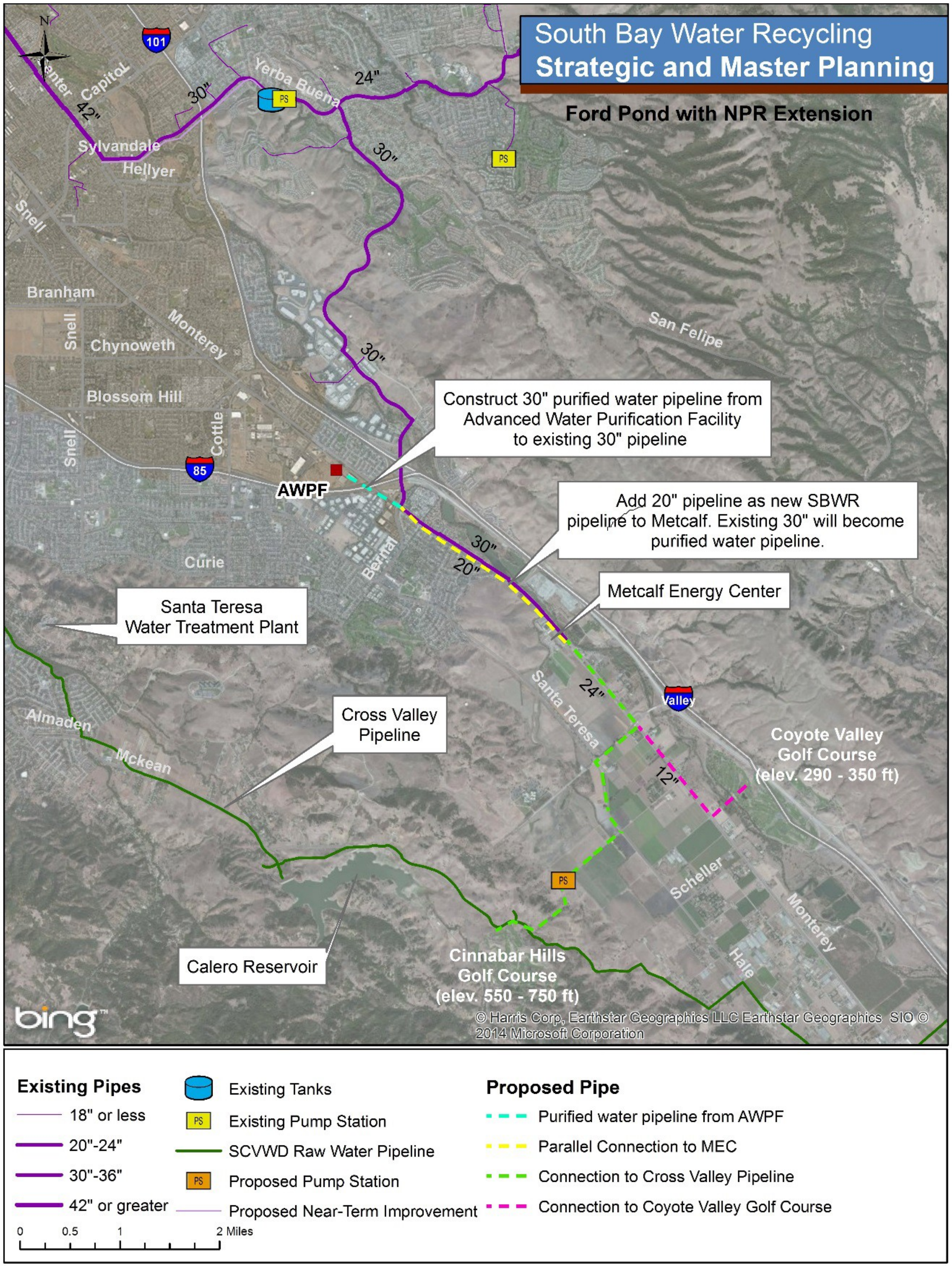
The Ford Pond near term project elements including the NPR extension to Cinnabar Hills are shown in Figure 5-2. The expanded near-term Ford Pond project includes the following preliminary infrastructure requirements:

- All of the facilities defined above for the Ford Pond near-term GWR project.
- Construct a 30-inch diameter purified water pipeline from the AWPF to the existing 30-inch diameter pipeline where the potable reuse pipeline turns north to the Ford Pond.
- Construct a 20-inch diameter pipeline from the where the new 30 inch diameter purified water pipeline ends to the MEC. The new pipeline would be parallel to the existing pipeline to the MEC.
- Connect the new 20-inch diameter pipeline to the existing SBWR system to serve the MEC.
- Connect the new 30-inch diameter pipeline to the existing 30-inch diameter SBWR pipeline and repurpose the pipeline to carry purified water instead of Title 22 water.
- Construct a blending station where the 20-inch and 30-inch diameter pipelines “connect” to

5.3 Direct Potable Reuse in the Cross Valley Pipeline

The Ford Pond GWR with a pipeline to the Cross Valley Pipeline is also a conceptual opportunity to extend the use of recycled water in the Coyote Valley. The concept for direct potable reuse in the Cross Valley Pipeline is to produce purified recycled water at an expanded Ford Pond satellite AWPF and add it to the Cross Valley Pipeline within the Coyote Valley. The Cross Valley Pipeline is a 78-inch pipeline that conveys imported Central Valley Project (CVP) water from the San Luis Reservoir to the District’s service area. The raw water can be conveyed by gravity from the Pacheco Regulating Tank or from the Anderson Reservoir; or by pumping from the Coyote Pumping Plant, as required by the system demand

Figure 5-2: Ford Pond GWR with NPR Extension Project


South Bay Water Recycling
Strategic and Master Planning

Ford Pond with NPR Extension

Construct 30" purified water pipeline from Advanced Water Purification Facility to existing 30" pipeline

Add 20" pipeline as new SBWR pipeline to Metcalf. Existing 30" will become purified water pipeline.

Metcalf Energy Center

Santa Teresa Water Treatment Plant

Cross Valley Pipeline

Calero Reservoir

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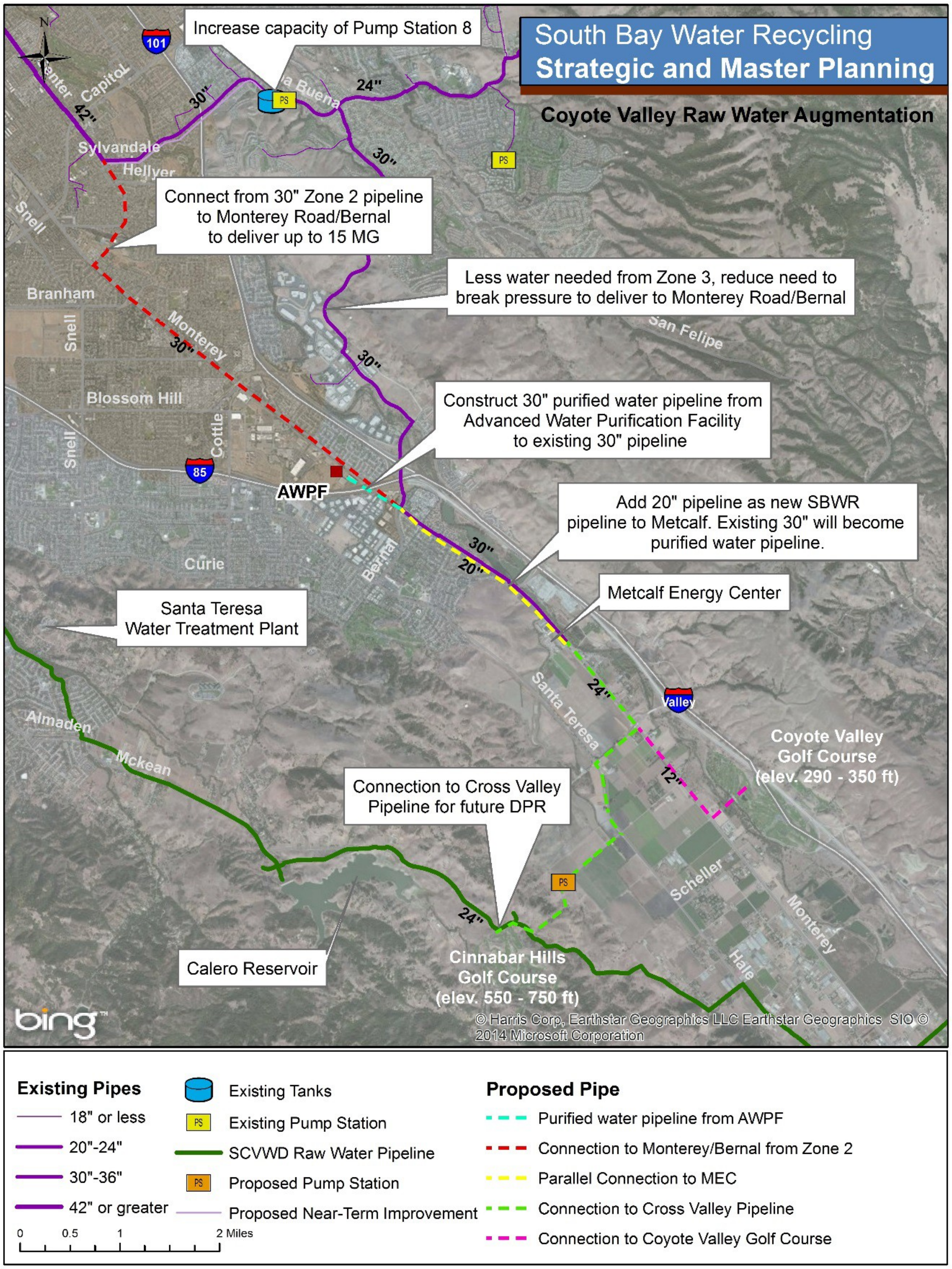
Figure 5-3: Cross Valley Pipeline Raw Water Augmentation Direct Potable Reuse Concept


South Bay Water Recycling
Strategic and Master Planning
Coyote Valley Raw Water Augmentation
Increase capacity of Pump Station 8
Connect from 30" Zone 2 pipeline to Monterey Road/Bernal to deliver up to 15 MG
Less water needed from Zone 3, reduce need to break pressure to deliver to Monterey Road/Bernal
Construct 30" purified water pipeline from Advanced Water Purification Facility to existing 30" pipeline
Add 20" pipeline as new SBWR pipeline to Metcalf. Existing 30" will become purified water pipeline.
Metcalf Energy Center
Santa Teresa Water Treatment Plant
Connection to Cross Valley Pipeline for future DPR
Calero Reservoir
Coyote Valley Golf Course (elev. 290 - 350 ft)
Cinnabar Hills Golf Course (elev. 550 - 750 ft)
AWPF
N
101
85
Valley
PS
Capitol
Sylvandale
Hellyer
Snell
Branham
Monterey
Blossom Hill
Cottle
Curie
Bernal
San Felipe
Santa Teresa
Almaden
Mckean
Scheller
Hale
42"
30"
24"
20"
12"
bing
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2014 Microsoft Corporation
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
SCVWD Raw Water Pipeline
Proposed Pump Station
Proposed Near-Term Improvement
Proposed Pipe
Purified water pipeline from AWPF
Connection to Monterey/Bernal from Zone 2
Parallel Connection to MEC
Connection to Cross Valley Pipeline
Connection to Coyote Valley Golf Course
0
0.5
1
2 Miles

For efficient operation of the District surface water treatment plants, a consistent and steady supply is required. Impacts from combining the raw water with the recycled water could impact the need for storage volume ahead of the water treatment plants

As discussed in Section 3.2 above, in the absence of direct potable reuse guidelines in California, it is assumed that full advanced treatment plus an additional disinfection step would be needed. The additional disinfection step would take place at the Ford Pond satellite AWPF. The pressure required to pump into the Cross Valley Pipeline would be higher than the pressure needed for groundwater replenishment at the recharge ponds; thus, two pump stations would be necessary at the Ford Pond satellite AWPF. Alternatively, a remote pump station could be located near the connection to the Cross

As shown in Figure 5-3, the Cinnabar Hills Golf Club is located adjacent to the Cross Valley Pipeline. As discussed in Section 3, one approach would be to oversize the pipeline to the Cinnabar Hills Golf Club and re-purpose this pipeline for direct potable reuse in the future. The connection to the Cross Valley Pipeline could be made in the vicinity of the Cinnabar Hills Golf Club. It should be noted that this connection is upstream of the Calero Reservoir. A pipeline between the Ford Pond AWPF and the Metcalf Energy Center would be necessary to allow the Metcalf Energy Center to continue to receive

Connecting upstream of Calero Reservoir would blend the purified recycled water with the raw water in the Cross Valley Pipeline, which would also add recycled water to the reservoir. This suggests that this project would be a both a direct potable reuse (Cross Valley Pipeline to the Santa Teresa Water Treatment Plant) and an indirect potable reuse (reservoir augmentation in Calero Reservoir) project. Connecting to the Almaden Pipeline, downstream of the connection to Calero Reservoir, would not alleviate this complication because the Almaden Pipeline has turnouts to creeks and recharge ponds downstream of the connection to the Santa Teresa Water Treatment Plant. The approach for direct

If the connections to the Calero Reservoir and to the creek/recharge pond turnouts make this direct potable reuse concept into a reservoir and streamflow augmentation project, then the permitting challenges associated with this type of project would potentially be greater than those faced with other potable reuse options, such as indirect potable reuse at the Ford Pond. The recycled water could be piped directly to the Santa Teresa Water Treatment Plant to avoid implications of reservoir and streamflow augmentation but this pipeline would be long (5-6 miles) and would have to be constructed

For direct potable reuse, the capacity of the project is based on the available capacity in the raw water system to accept a new water source. The District completed WEAP modeling ("Water Evaluation and Planning" system) for the scenarios summarized in Table 5-1. The WEAP modeling assesses the District's overall water supply and the impacts of the new water supplies. The modeling is completed up through

Table 5-1: Coyote Valley WEAP Modeling Scenarios

Scenario	Description
1	• Ford Pond GWR Project (4,200 AFY)
2	• Ford Pond GWR Project (4,900 AFY) • Direct Potable Reuse (4,900 AFY)
3	• Direct Potable Reuse (9,800 AFY)

Note: For Scenarios 2 and 3, the capacities were adjusted to a total of 8,400 AFY after the WEAP modeling was completed in October 2014. The project is conceptualized as an 8,400 AFY project, but the model was not re-run for the updated conditions.

The detailed WEAP model results are presented in Appendix A for the three scenarios described in Table 5-1, a baseline run that represents the District's current water supplies, and the prior modeling that was completed for the Central Pipeline potable reuse option. The WEAP modeling was performed using an October 2014 baseline condition. The WEAP modeling findings referenced herein are from 2011 model runs based on the District's 2010 Urban Water Master Plan. The WEAP model simulations would need to be redone to accommodate any new assumptions since the 2010 UWMP was adopted, such as new

In summary, the near-term Ford Pond GWR project with direct potable reuse would reduce the unmet treated water demands and reduce the number of months that the District requires mandatory water use reduction. Both projects would also increase the amount of Central Valley Project (CVP) water and State Water Project (SWP) water that could be diverted to other uses. The baseline run has both CVP and SWP water that are not used ("carryover water"), but the amount of water increases for all three of the system modeling scenarios97241 described in Table 5-1. If the District pursues the Ford Pond and Coyote Valley projects, the District will have to make a policy decision about the priorities involved with

5.4 Reservoir Augmentation in Calero Reservoir

The Ford Pond GWR with reservoir augmentation in Calero Reservoir is a third conceptual opportunity to extend the use of recycled water in the Coyote Valley. For reservoir augmentation in Coyote Valley, the District could consider pursuing a reservoir augmentation project at Calero Reservoir. Calero Reservoir has a storage volume of 9,934 AF is located west of Coyote Valley in the eastern foothills of the Santa Cruz Mountains. The reservoir captures and stores stormwater runoff, recharges the water from the Central Valley Project through Cross Valley Pipeline. Water is released to downstream percolation ponds for groundwater replenishment. During low-flow periods, the water is used to feed the Santa Teresa Water Treatment Plant. The District and the Santa Clara County Parks Department work together to provide recreation around and in the reservoir, including power boating, sailing,

The reservoir is currently operated in two methods:

1. In the winter months, the reservoir is supplied by limited runoff from its watershed as well as runoff from the nearby Almaden Reservoir. The reservoir normally operates at high levels during the rainy season.
2. In dry months, the reservoir normally runs at half capacity, enough to maintain the emergency storage and provide recreational activities. During the summer months, the reservoir can

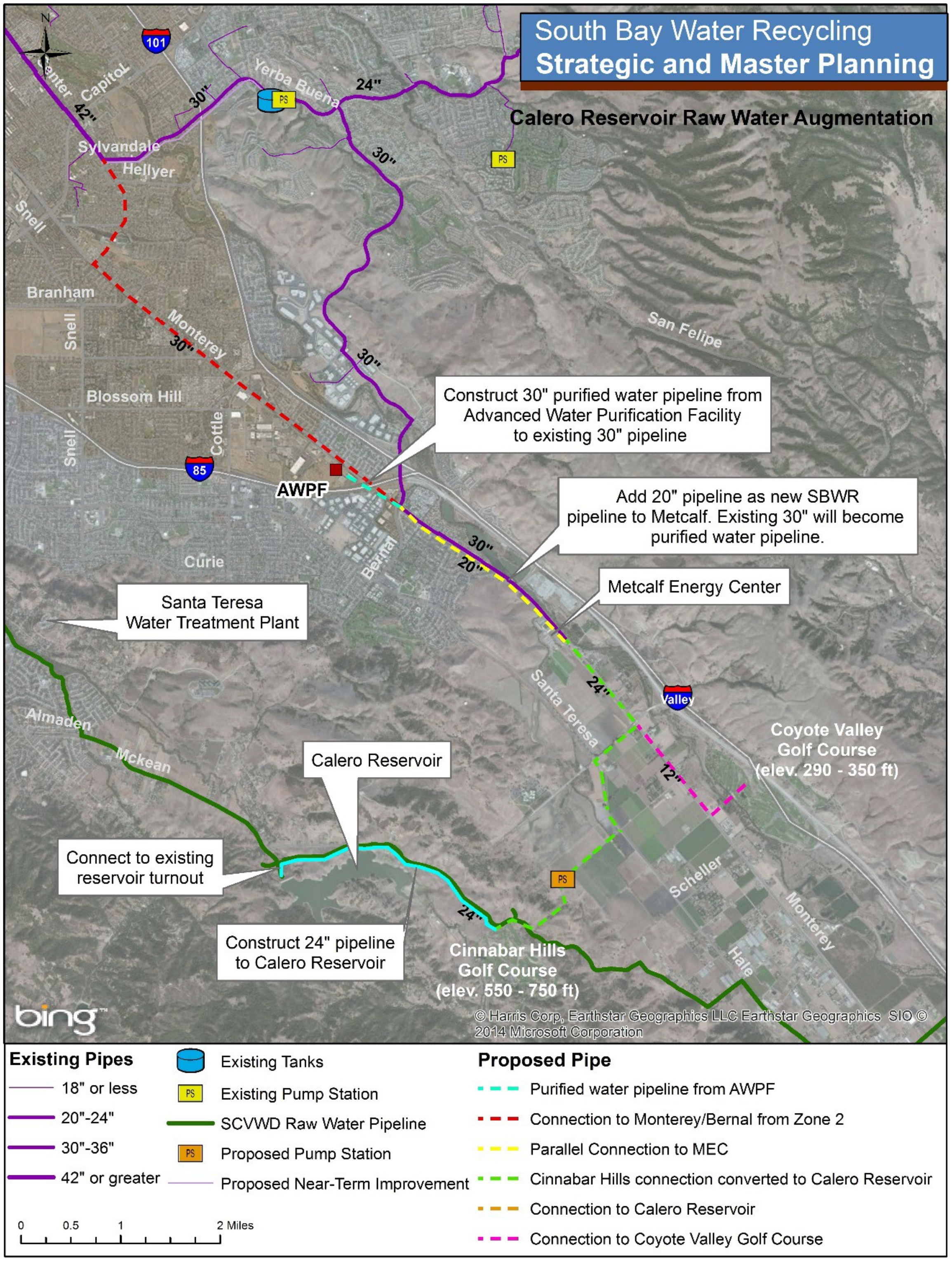
The District currently maintains a minimum of 4,000 AF of emergency storage in the bottom of the reservoir because of restrictions by the California State Division of Safety of Dams placed on the reservoir. The dam is being refitted so that the present winter and summer operations will not be the normal operation of the reservoir. In the future, the reservoir will be operated under the current winter curves (method 1) and slowly released during the summer based on the operations curve and downstream recharge demands. The reservoir typically discharges into Alamitos Creek for recharge.

By developing a reservoir augmentation project at Calero Reservoir, additional water could be utilized for (1) maintaining reservoir level, (2) recharge at downstream percolation ponds or (3) providing additional water to Santa Teresa during low flow periods

See Figure 5-4 for the reservoir augmentation facilities.

As discussed in Section 3.2, regulations for reservoir augmentation do not currently exist but are anticipated by the end of 2016. In absence of regulations, it is reasonable to assume that requirements for a reservoir augmentation project would include those developed for the San Diego project, which includes full advanced treatment but alternative treatment such as ozone-BAC might be allowed if nutrient limits for TN and phosphorus are not an issue. As with the concept for direct potable reuse in

Figure 5-4: Calero Reservoir Raw Water Augmentation Reuse Concept


South Bay Water Recycling
Strategic and Master Planning
Calero Reservoir Raw Water Augmentation
N
101
Center
Capitol
42"
30"
Yerba Buena
24"
PS
30"
Sylvandale
Hellyer
Snell
Branham
Snell
Monterey
30"
30"
San Felipe
Blossom Hill
Cottle
Snell
85
AWPF
Construct 30" purified water pipeline from Advanced Water Purification Facility to existing 30" pipeline
Add 20" pipeline as new SBWR pipeline to Metcalf. Existing 30" will become purified water pipeline.
30"
20"
Bernal
Curie
Metcalf Energy Center
Santa Teresa Water Treatment Plant
Santa Teresa
24"
Valley
Coyote Valley Golf Course (elev. 290 - 350 ft)
12"
Almaden
Mckean
Calero Reservoir
Connect to existing reservoir turnout
PS
Schellel
Construct 24" pipeline to Calero Reservoir
24"
Cinnabar Hills Golf Course (elev. 550 - 750 ft)
Monterey
Hale
bing
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2014 Microsoft Corporation
Existing Pipes
18" or less
20"-24"
30"-36"
42" or greater
Existing Tanks
Existing Pump Station
SCVWD Raw Water Pipeline
Proposed Pump Station
Proposed Near-Term Improvement
Proposed Pipe
Purified water pipeline from AWPF
Connection to Monterey/Bernal from Zone 2
Parallel Connection to MEC
Cinnabar Hills connection converted to Calero Reservoir
Connection to Calero Reservoir
Connection to Coyote Valley Golf Course
0 0.5 1 2 Miles

Cross Valley Pipeline, the reservoir augmentation concept is based on producing additional purified recycled water at an expanded Ford Pond satellite AWPF.

The pressure required to pump to Calero Reservoir will be greater than the pressure needed for groundwater replenishment at the recharge ponds, so two pump stations would be needed at the Ford Pond satellite AWPF. Alternatively, a remote pump station could be located in the distribution system. If the non-potable pipeline to Cinnabar Golf Club is re-purposed for reservoir augmentation, then the

The reservoir augmentation regulations currently being developed by DDW will include requirements for dilution, retention time, or a combination of both. To pursue reservoir augmentation, a reservoir model would be required to ensure the water does not short-circuit because of stratification.

An outlet structure would need to be constructed at the Calero Reservoir to allow discharge of the recycled water into the reservoir. As noted above, extensive hydrodynamic modeling will be required to show that the Calero Reservoir can provide adequate blending and retention time. The modeling will also help determine the best location for the discharge structure. Multiple discharge structure could be required to allow for proper mixing during different times of the year as the storage volume and

Reservoir augmentation projects face a challenging regulatory/permitting environment as surface water discharges of treated wastewater are considered discharge of a “waste” to the waters of the U.S. Regulations for reservoir augmentation are currently under development by DDW and projects are approved on a case-by-case basis, requiring extensive coordination with regulatory agencies. Additional study is necessary to demonstrate to regulators and resource agencies that recycled water could be discharged to surface water bodies without negatively affecting wildlife in the study area. These permitting challenges are greater than required for other potable reuse options under consideration in the SBWR Strategic and Master Plan. Therefore, implementing a reservoir augmentation project at Calero Reservoir is not recommended at this time. The District should track the development of the

5.5 Summary

Table 5-2 summarizes the three potential potable reuse opportunities for Coyote Valley, and the advantages/disadvantages of each one. Based on this evaluation, the most feasible pathway for potable reuse in Coyote Valley is to start with the Ford Pond GWR project as the anchor and expand into direct potable reuse or reservoir augmentation in the future. Regulatory issues for the supply of direct potable or recycled water for reservoir augmentation and possibly the implementability of surface water

Table 5-2: Coyote Valley Potable Reuse Pathways

Pathway	Ford Pond GWR with NPR (Near Term)	Direct Potable Reuse (Long-Term)	Reservoir Augmentation (Long-Term)
Project Description	• Use near term satellite AWPF located in the vicinity of Ford Pond • NPR in Coyote Valley area (blend of SBWR recycled water and purified recycled water for TDS reduction) • Full advanced treatment (MF, RO, AOP) • Pipeline to Coyote Valley/ Cinnabar Hills Golf Clubs	• Expand satellite AWPF located in vicinity of Ford Pond • Direct potable reuse in the Cross Valley Pipeline • Full advanced treatment (MF, RO, AOP) assumed at this time • Potentially reuse the NPR water pipeline to Cinnabar Hills Golf Club to convey	• Expand satellite AWPF located in vicinity of Ford Pond • Reservoir augmentation at Calero Reservoir • Full advanced treatment (MF, RO, AOP) assumed at this time • Potentially reuse the NPR water pipeline to Cinnabar Hills Golf Club to convey
Advantages	• Can be implemented with current regulations • No stranded assets as the near-term project can become a part of the two potential long-term pathways	• Provides maximum flexibility to use recycled water • State law enables permit compliance at entrance to raw water system, potentially avoiding need for NPDES permit and abiding by California Toxics Rule (CTR) requirements	• While regulations do not currently exist for reservoir augmentation, guidelines have been established and a project has received conceptual approval • Maximizes use of existing facilities • Provides an environmental
Disadvantages	• Some AWPF capacity will be used to lower the TDS of NPR water • Requires a larger pipeline to the Cinnabar Hills Golf Club for future potable reuse to avoid stranded assets or parallel pipelines • Modifications to the existing SBWR system to supply NPR water • If direct potable reuse or reservoir augmentation is implemented, the golf course water source would revert back to potable water	• Regulations do not currently exist for direct potable reuse and criteria guidance is not anticipated until the end of December 2016 • Full advanced treatment assumed, which will increase the amount of brine requiring disposal	• Reservoir augmentation faces a challenging regulatory/permitting environment as surface water discharges of treated wastewater are considered discharge of a "waste" to the waters of the U.S. • Full advanced treatment assumed, which will increase the amount of brine requiring disposal • Higher costs than other potable reuse alternatives (based on the District's evaluation of reservoir

6. Coyote Valley Potable and Non-Potable Reuse Concept Options

6.1 Concept Summary

The District is interested in developing additional potable and non-potable recycled water projects in Coyote Valley to provide new drought-proof water supplies, both raw water and non-potable water for existing surface water customers. Based on the evaluation of non-potable and potable reuse concepts, the District can consider providing recycled water to the major surface water users in Coyote Valley, including both the Cinnabar Hills and Coyote Golf Clubs. Non-potable recycled water can be provided in the near-term while implementing a potable reuse project in the long-term. Both reservoir augmentation and direct potable reuse are deemed to be feasible for the Coyote Valley as long as the regulatory and institutional issues can be resolved. Ongoing regulatory analysis and an evaluation of the management of carryover water from the CVP and SWP, which could be impacted differently through

6.2 Conceptual Cost Estimates

This section includes the conceptual cost estimates for the NPR system improvements described in Section 4 and the potable reuse options discussed in Section 5. For potable reuse, costs are presented for the near-term Ford Pond GWR project with NPR distribution to Coyote Golf Club, and for the long-term direct potable reuse project in the Cross Valley Pipeline and for reservoir augmentation. Costs

1. Near-Term Ford Pond GWR with NPR Extension
   - Ford IPR project as described in the Strategic and Master Planning Report.
   - Conveyance to serve NPR users (golf courses):
     - 17,000 LF of 24-inch pipeline
     - 13,000 LF of 12-inch pipeline
     - 2.2-mgd booster pump station
2. Long-Term Ford Pond GWR Concepts (DPR & RA)
   - Common Facilities
     - Expand AWPF production capacity from 4 to 8 mgd.
     - 4,000 LF of 30-inch pipeline for NPR
     - Convert NPR pipelines constructed in near-term to convey purified recycled water.
     - Upgrade NPR pump station constructed in near-term to convey purified
   - Option 1 DPR:
     - 500 HP pump station to transfer purified recycled water into the Cross Valley Pipeline

3. Long Term SBWR Improvements to Serve Coyote Valley
    - Option 2 Reservoir Augmentation:
        - 14,000 LF of 24-inch pipeline to connect to Calero Reservoir
    - Long-Term NPR Option 1 Concept
        - Pump upgrade/replacement at PS 11
    - Long-term NPR Option 2 Concept
        - Pump upgrade/replacement at PS 8
        - 27,000 LF of 30-inch pipeline

The capital cost estimates for the near-term and long-term concepts were developed based on previous District estimates, estimates in the Strategic and Master Planning Report, other similar IPR/NPR projects, equipment cost quotations from vendors, industry publications, and typical pipeline installation costs in terms of cost per inch of pipeline length and inch diameter. Depending on the stage of the project and

Since the Strategic and Master Planning project is a preliminary planning phase project, these estimates are considered Class 5 estimates based on the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries (2005). Class 5 estimates are based on a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate is -20 to -50

In addition, the capital costs include the following contingency and markups:

- 20 percent contingency to account for unknown or unforeseen construction costs.
- 30 percent implementation factor to account for the costs for program management, planning and environmental documentation, permits, engineering, design and construction services, construction management and inspections, and typical overhead items such and legal and
- administration services.

O&M costs are the recurring annual expense to operate and maintain the facilities after construction is completed. The O&M cost elements include items such as power, labor, chemicals, replacement of consumables (membranes, pumps), maintenance, and AWPF waste (MF backwash and RO concentrate) management for potable reuse pathways. The O&M cost estimates for the pathways are developed based on previous District estimates, other similar IPR/NPR projects, replacement equipment cost quotations from vendors, industry publications, and pumping horsepower estimates. A contingency is

Table 6-1 summarizes the near-term and long-term cost estimates for the Ford Pond GWR with NPR extension, and the Coyote the potable reuse pathway and for reservoir augmentation. The near-term capital cost estimates is based on an AWPF production capacity is 4,200 AFY b. In the long-term, the AWPF production capacity will increase by 4,200 AFY for a total of 8,400 AFY.

Annual O&M costs include labor, equipment replacement, chemical replacement, and power requirements at the AWPF. Power required for the new pump station at the Cinnabar Hills Golf Club is estimated for an average annual delivery of 350 AFY. The annual O&M costs also include a City of San José industrial discharge fee for discharge AWPF waste to the sanitary sewer. This cost is approximately

Table 6-2 summarizes the cost estimates for the SBWR system improvements necessary to serve the long-term (additional 5 mgd) Coyote Valley potable reuse pathway. Option 1 involves improvements to PS 11 to deliver the additional 5 mgd of SBWR water required in the long-term. Option 2 is comprised of improvements to PS 8 and the construction of 27,000 LF of 30-inch pipeline along Monterey Road to deliver the additional 5 mgd. O&M costs for both options include annual equipment O&M and power

Table 6-1: Coyote Valley Potable Reuse Pathway Concept Cost Estimate[1,2]

IPR Pathway	Concept Element Costs	
Near-Term (4,200 AFY)	**Ford Pond GWR w/ NPR Extension**	
Capital Cost ($M)	$81.6	
Annualized Capital Costs ($M)[3]	$4.2	
Annual O&M Costs ($M)	$4.2	
Total Annualized Cost ($M)[4]	$8.4	
Long-Term (4,200 AFY)	**DPR**	**RA**
Capital Cost ($M)	$61	$62
Annualized Capital Costs ($M)[3]	$3.1	$3.1
Annual O&M Cost ($M)	$4.1	$3.5
Total Annualized Cost ($M)[4]	$7.2	$6.6

Notes:

1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.

2 – Note that the Ford Pond IPR costs are higher than shown in Table 8-6 of the SBWR Strategic and Master Planning Report because the costs shown in this Table 6-1 include the Coyote Valley NPR costs.

3 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%. Recharge capacity and associated costs are for each phase, respectively.

4 – Does not include SBWR recycled water purchase rate. Annual O&M cost will increase when this item is incorporated.

5 – Cost per AF will increase once the O&M cost elements identified in Note 3 are included in the estimate.

Table 6-2: Long-Term SBWR System Improvements to Serve Coyote Valley

Long-Term NPR Pathways	Concept Element Costs
Option 1 – Improvements to PS 11	**5,600 AFY**
Capital Cost ($M)	$5.8
Annualized Capital Costs ($M)[2]	$0.3
Annual O&M Costs ($M)	$0.5
Total Annualized Cost ($M)[3]	$0.8
Option 2 – Improvements to PS 8 and Monterey Road Pipeline	**5,600 AFY**
Capital Cost ($M)	$25.6
Annualized Capital Costs ($M)[2]	$1.3
Annual O&M Costs ($M)	$0.3
Total Annualized Cost ($M)[3]	$1.6

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.
2 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%. Capital costs do not include land/property acquisition, which would increase the capital cost.
3 – Power costs only account for pumping additional 5 mgd required at PS8 or PS11 in the long-term.

Attachments

Appendix A: DRAFT WEAP Modeling Results for Coyote Valley Reuse

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Appendix A
DRAFT WEAP Modeling Results for Coyote Valley Reuse

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DRAFT Coyote Potable Reuse: Baseline, Ford Road Ponds and Cross Valley Pipeline Scenarios

	Baseline Scenario: "2035 Baseline, October 2014"	**Project Scenario 1:** "2035 Coyote Reuse 1 - Ford 4200 AFY"	**Project Scenario 2:** "2035 Coyote Reuse 2 - Ford 4900 AFY + XValley 4900"	**Project Scenario 3:** "2035 Coyote Reuse 3 - XValley 9800 AFY"	**Baseline Scenario:** Potable Reuse to C Pipeline
reated Water Demand (AF)					
Average	753	737	503	360	
Maximum	23,950	24,541	20,776	17,322	
Minimum	0	0	0	0	
Count of Years > 1,000/Year	7	7	3	3	
Count of Years > 5,000/Year	4	3	3	2	
water Storage, All (AF, %, or count)					
Average Monthly	449,294	455,030	458,017	456,669	
Maximum Monthly	523,645	522,543	524,176	523,336	
Minimum Monthly	196,219	209,466	239,360	234,587	
Alert Stage 1 (No Conservation)	95%	96%	96%	96%	
Alert Stage 2 (10% Conservation)	1%	1%	3%	1%	
Alert Stage 3 (20% Conservation)	4%	3%	1%	3%	
Alert Stage 4 (25% Conservation)	0%	0%	0%	0%	
Alert Stage 5 (50% Conservation)	0%	0%	0%	0%	
Count of Months in Alert Stage[1] 2	20	1	2	1	
Count of Months in Alert Stage 3	28	2	1	2	
Count of Months in Alert Stage 4	2	0	0	0	
Count of Months in Alert Stage 5	0	0	0	0	
ara Plain Subbasin Storage (AF)					
Average Monthly	297,820	304,201	307,999	306,435	
Maximum Monthly	350,000	350,000	350,000	349,243	
Minimum Monthly	75,597	89,498	120,915	114,908	
ount of Years Ending < 150,000 AF					
Valley Subbasin Storage (AF)					
Average Monthly	17,815	17,230	16,614	16,739	
Maximum Monthly	24,178	24,141	23,947	24,404	
Minimum Monthly	0	0	0	0	
Count of Years Ending < 5,000 AF					
ubbasin Storage (AF)					
Average Monthly	133,659	133,599	133,403	133,495	
Maximum Monthly	152,063	152,197	151,048	150,921	
Minimum Monthly	75,204	75,204	75,204	75,204	
ount of Years Ending < 31,000 AF					
ryover "Not Used" (AF)					
Sum	538,975	627,479	851,620	940,902	
Average	6,822	7,943	10,780	11,910	
Maximum	184,967	185,092	188,042	190,892	
Minimum	0	0	0	0	
Critically Dry Average	4	2	1	2	
Dry Average	1	0	40	340	
Below Normal Average	4,471	4,680	5,173	5,332	
Above Normal Average	2,524	2,419	4,828	5,785	
Wet Average	17,424	20,769	28,097	30,839	
rryover "Not Used" (AF)					
Sum	74,700	88,900	109,500	119,300	
Average	946	1,125	1,386	1,510	
Maximum	36,163	36,342	35,409	37,850	
Minimum	0	0	0	0	
Critically Dry Average	0	0	0	0	
Dry Average	0	0	0	0	
Below Normal Average	955	959	959	955	
Above Normal Average	245	666	1,268	1,268	
Wet Average	2,292	2,658	3,196	3,575	
pic Reservoir Storage (AF)					
Average Monthly	228,232	240,850	253,358	254,860	
Maximum Monthly	344,983	344,984	344,983	344,982	
Minimum Monthly	41,779	52,781	87,467	94,976	
Count of Years Ending 0 AF					
pic Reservoir, Banked Water Sold (AF)					
Average	4,374	6,170	8,451	7,929	
Maximum	44,983	44,984	44,983	44,982	
Minimum	0	0	0	0	
Count?					
n Reservoir Storage (AF)					
Average Monthly	54,236	51,455	48,747	48,795	
Maximum Monthly	90,373	90,373	90,373	90,373	
Minimum Monthly	21,580	20,973	20,317	20,317	
Count?					
Creek, flows to SF Bay (AF)					
Sum	1,511,110	1,486,051	1,414,358	1,391,990	1
Average	19,128	18,811	17,903	17,620	
Maximum	198,545	197,631	198,620	197,402	
Minimum	0	0	0	0	
Count?					
eservoir Storage (AF)					

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Appendix 8B - Mid-Basin Injection Indirect Potable Reuse Study Technical Memorandum

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South Bay Water Recycling
Strategic and Master Planning

Technical Memorandum

Title: **Mid-Basin Injection Indirect Potable Reuse Study**
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Date: **December 16, 2014**
Reference: **Task 3.1.1 Mid-Basin IPR Study**

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1. Introduction

1.1 TM Purpose

The purpose of this Mid-Basin Injection Indirect Potable Reuse (IPR) Study is to further develop the concept of implementing a near-term potable reuse project within the City of Santa Clara. This technical memorandum (TM) was developed as part of the SBWR Strategic and Master Planning Report (Strategic Plan, RMC/CDM Smith 2014), which was prepared by the City of San José (San José) in partnership with the Santa Clara Valley Water District (SCVWD or District), to evaluate how recycled water produced from the San José/Santa Clara Regional Wastewater Facility (SJ/SC RWF) could be used to meet the Strategic

SCVWD has a goal of expanding recycled water so that it supplies at least 10 percent of countywide water demands. This results in a goal of 40,000 AFY of recycled water use by 2025 and 50,000 AFY of use by 2035. In addition, SCVWD’s 2012 Water Supply and Infrastructure Master Plan (WSIMP) calls for a total of 50,000 AFY recycled water by 2035. A baseline county-wide recycled water production of 15,000 AFY was chosen as a starting point, translating into a need to develop an additional 25,000 AFY of recycled water use by 2025 followed by an additional 10,000 AFY by 2035 (to reach a total additional use

Table 1-1: Strategic Plan Recycled Water Targets

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: These targets are based on a baseline county-wide recycled water use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand).
Source: SBWR Strategic and Master Planning Report (RMC/CDM Smith, 2014).

While the SCVWD plans to meet its recycled water targets with sources throughout the county, for planning purposes, the SBWR master planning targets assume that SCVWD’s additional recycled water needs would be met by the RWF. It is assumed that any near- or long-term wastewater flow diversion

This TM presents the concept for a near-term, temporary mid-basin injection project in the City of Santa Clara (Santa Clara), hydrogeologic considerations for the project, and additional information about the near-term project, including a site plan, conceptual cost estimate, permitting, implementation schedule,

1.2 TM Background

The concept explored in this TM is a near-term IPR project that would include a temporary 1 million gallon per day (mgd) satellite advanced water purification facility (AWPF) to produce purified recycled water that would be recharged to the groundwater basin through an injection well. This project would demonstrate to the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), formerly the California Department of Public Health, and San Francisco Regional Water Quality Control Board (RWQCB) the feasibility of IPR using injection wells in the mid-basin area and support the development of the long-term potable reuse program. Successful project experience could potentially result in greater ease of permitting the subsequent long-term potable reuse plan, demonstrated by a project with successful treatment plant operation, no negative water quality impacts to nearby water

Note that the size of the near-term project would be determined at a later date based on future groundwater modeling. This TM is based on an assumed capacity of 1 mgd, which is based on the upper end of the estimated capacity of a single injection well. This project would operate for approximately 8 to 10 years as a temporary project since it would eventually be replaced by a larger, permanent long-

The SBWR Strategic Plan has described a long-term potable reuse plan that includes a 5-mgd mid-basin injection project in Santa Clara that would be implemented by the District in coordination with Santa Clara and South Bay Water Recycling (SBWR). This long-term potable reuse program would produce purified recycled water at a centralized AWPF located adjacent to the Silicon Valley Advanced Water Purification Center (SVAWPC) which provides TDS reduction and operational benefits for the SBWR non-potable reuse (NPR) system. The SVAWPC is located in San José next to the SJ/SC RWF. The water would be conveyed through a new pipeline to multiple IPR projects in Santa Clara (direct injection), to the Los

1.3 TM Organization

This TM is organized as follows:

1. Introduction
2. Project Concepts
3. Preliminary Hydrogeologic and Regulatory Evaluation
4. Preliminary Project Description
5. Permitting
6. Conceptual Cost Estimate

2. Project Concepts

As mentioned above, the concept for a larger, permanent mid-basin injection IPR project has been developed as part of the Strategic Plan. Part of the overall potable reuse project concept is to recharge the region's main groundwater basin with purified recycled water. The water would be extracted from the basin through existing production wells and used for potable water supply. Since the project concept includes recharging the groundwater basin with injection wells, the advanced water purification treatment would include reverse osmosis (RO) and an advanced oxidation process (AOP), which is

Table 2-2 provides the definitions for the near-term and long term project concepts as defined in the Strategic Plan.

Table 2-2: Strategic Plan Project Time Frame

Project	Year
Near-Term	2015-2020
Long-Term	After 2020

At this time, it is envisioned that the District and Santa Clara would pursue both the near-term and long-term mid-basin IPR injection projects in Santa Clara. The near-term project would be a temporary project that would eventually be replaced by the long-term project that would convey purified recycled water from a centralized AWPF to multiple injection wells in Santa Clara. These two project concepts are

Table 2-3: Near-term and Long-Term Mid-Basin Injection IPR Project Concepts

Parameter	Near-term	Long-Term
AWPF Location	Satellite AWPF located on Coleman Avenue	Centralized AWPF located adjacent to the SJ/SC RWF and SVAWPC
Source Water	SBWR recycled water system (existing 20-inch pipeline in Coleman Avenue)	SJ/SC RWF secondary effluent
Capacity (estimated)[1]	1 mgd	5 mgd
Injection Wells	One injection well	8 additional injection wells
Concentrate Management	Pipeline to sanitary sewer	Coyote Point outfall

Note: [1] Capacity will be confirmed with groundwater modeling.

2.1 Near-term Mid-Basin Injection Project Concept

This near-term mid-basin injection project would include the following elements:

- Temporary, trailer-based satellite AWPF with a production capacity of approximately 1 mgd.
- Injection well, which would either be a rehabilitated idle production well or a new injection well.
- AWPF and injection well would be located at property owned by Santa Clara at the northwest corner of Coleman Avenue and Brokaw Road.
- Tertiary recycled water would be supplied to the AWPF from the SBWR system
- RO concentrate would be discharged to the RWF collection system through an industrial

The AWPF unit processes would include membrane filtration (MF) using either microfiltration or ultrafiltration, reverse osmosis (RO), and advanced oxidation (AOP) with ultraviolet light (UV) and hydrogen peroxide (UV/peroxide). The capacity of the project is anticipated to be around 1 mgd and will be refined based on future groundwater modeling. This initial capacity was selected as an upper end of the anticipated capacity for a single injection well estimated from typical extraction well capacities in

The treatment processes, as well as the instrumentation and controls (I&C), electrical, and chemical facilities, would be installed in shipping containers or trailers instead of a permanent building. Trailer-mounted membrane equipment can be used when temporary facilities are desired, for smaller treatment facilities when standard equipment layouts are acceptable, and when facilities are desired that can be easily mobilized and demobilized. Such trailers were used for the Santa Barbara seawater desalination facility, built during the drought of the early 1990's and for the Cambria Emergency Water Supply project, built during the current drought. A trailer-mounted system was also used for a temporary 1-mgd membrane filtration facility in Yucaipa while their permanent facility was under construction. By applying this approach to the near-term mid-basin injection project, the processes can

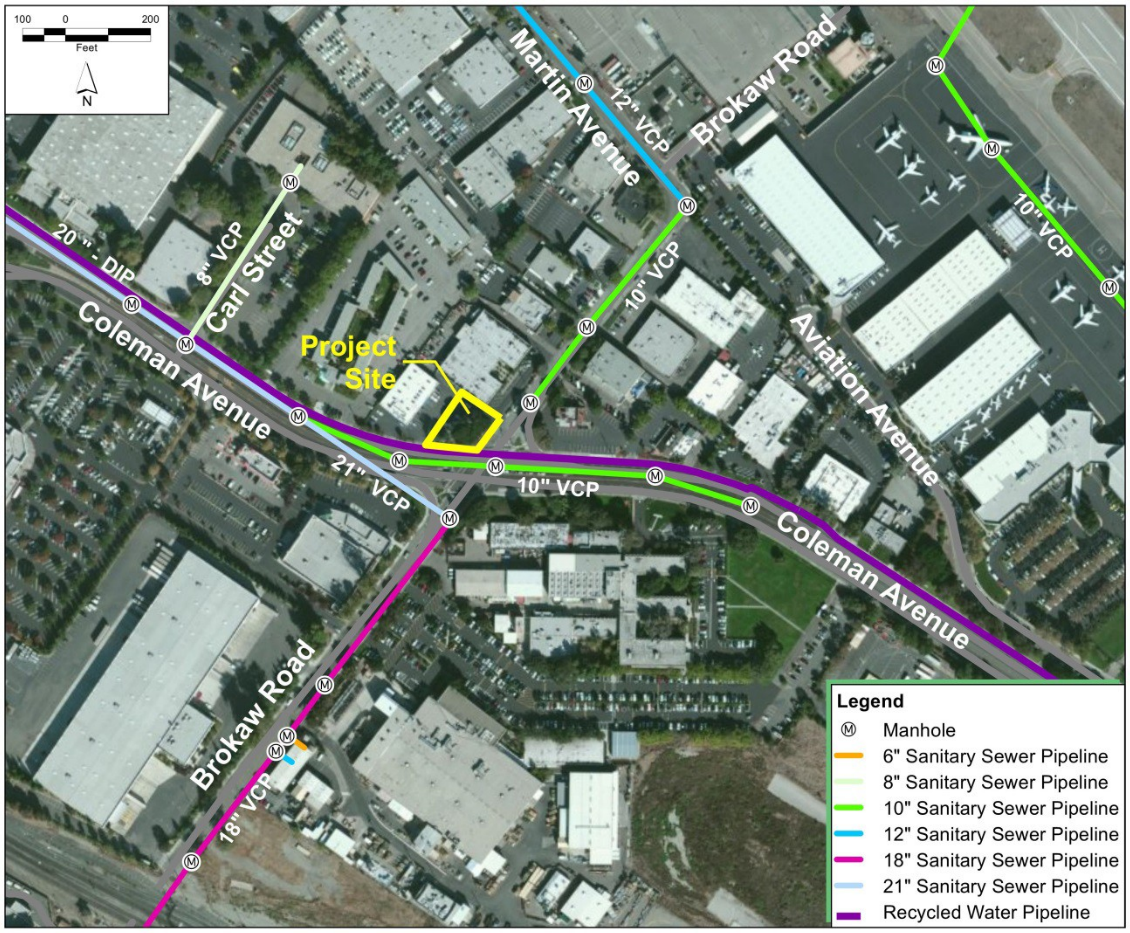
The proposed project site is currently owned by Santa Clara and is located at the northwest corner of Coleman Avenue and Brokaw Road. The site currently houses an existing Santa Clara production well that has been taken out of service. Santa Clara does not plan to rehabilitate or replace the well in this location, so this area is available for the temporary AWPF and the injection well. The injection well would be either the existing well with modifications/improvements to be used as an injection well or a new injection well. Additional inspection and testing is necessary to evaluate the suitability of the

Santa Clara relies on groundwater for 60 percent of their water supply and has an extensive network of groundwater production wells. Other nearby water purveyors include the City of San José and San José Water Company. The purified recycled water recharge project could potentially benefit all of the water

Preliminary SBWR system hydraulic modeling determined that the SBWR system should have sufficient tertiary recycled water capacity at the proposed AWPF location; therefore, no capital improvement to the SBWR system would be necessary for this near-term project. A 20-inch diameter SBWR recycled water pipeline is located in Coleman Avenue on the north side of the site which would supply the recycled water to the temporary AWPF (see Figure 2-1). To produce 1 mgd of purified recycled water, approximately 1.24 mgd of tertiary recycled water would be needed. Since the AWPF is not a critical demand, the AWPF could be treated as an interruptible customer and recycled water delivery could be suspended during short periods of peak demands if sufficient feed water was not available. There is a 21-inch diameter sanitary sewer located in Coleman Avenue that is anticipated to have sufficient

It is anticipated that this near-term, temporary project would ultimately be approved with a 100 percent recycled municipal wastewater contribution (RWC) since the project employs full advanced treatment, but it is acknowledged that the project could need to start at a lower RWC and eventually ramp up to the desired 100 percent RWC. Because of the desire to eventually achieve a 100 percent RWC, it is envisioned that the initial project would rely on native groundwater flowing through the injected recycled water zone of influence to achieve the initial RWC, as opposed to blending the purified recycled water with potable water (diluent water) at the injection well. Successful operation of this project could

Figure 2-1: Project Site Location



2.2 Long-Term Mid-Basin Injection Project Concept

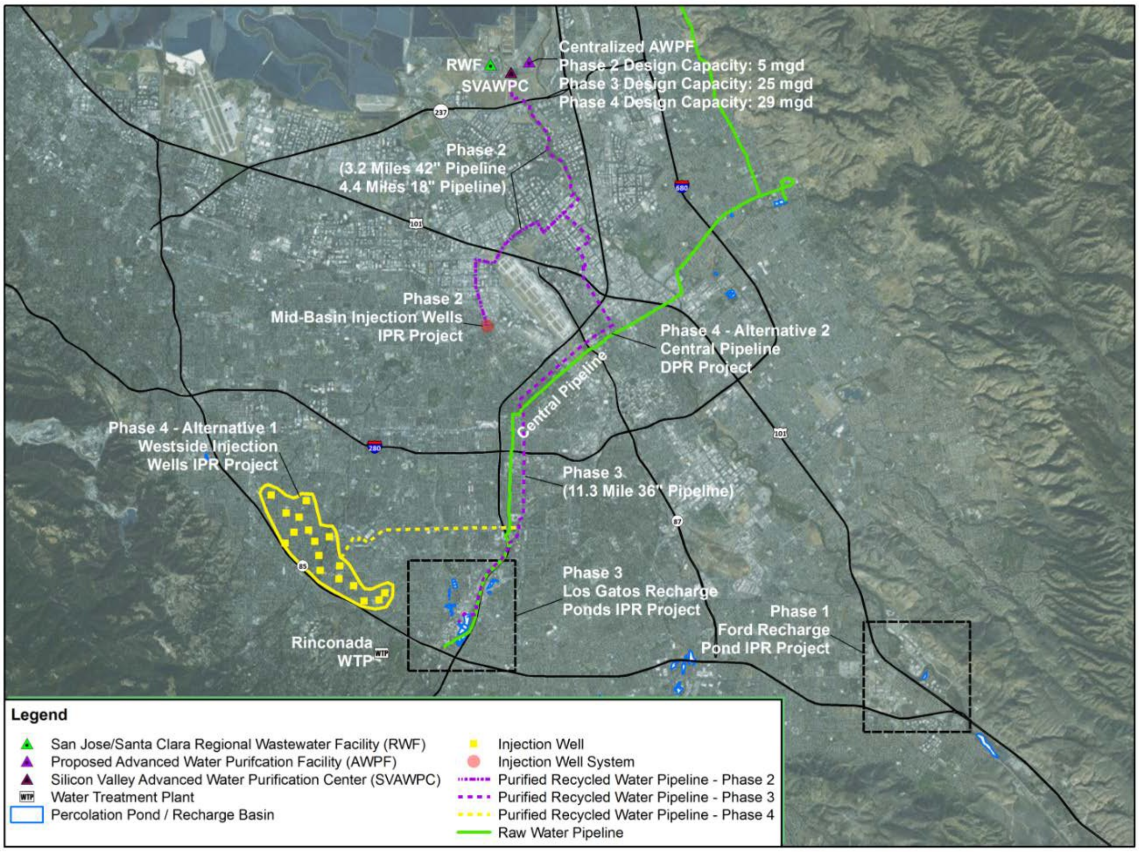
A larger, permanent mid-basin injection project is included as part of the long-term recommended plan for potable reuse in the Strategic Plan. The long-term potable reuse plan (see Figure 2-2) includes implementation of an indirect potable reuse project at the Los Gatos Recharge ponds, which requires a pipeline to be installed to convey purified recycled water from a future centralized AWPF to the Los Gatos recharge ponds. The mid-basin injection project would be served from this pipeline. This project

- The first phase of a new centralized AWPF.
- A conservative estimate of nine injection wells would be needed, which would be located in Santa Clara. The injection well from the near-term project could be reused as part of the long-term project. The number of injection wells would be refined after the near-term project has

- Pipeline between a centralized AWPF and the mid-basin injection wells, which would be a portion of the pipeline needed to ultimately convey water to the Los Gatos recharge ponds.

It is envisioned that this long term mid-basin project would have a capacity of approximately 5 mgd (5,600 AFY) which would be confirmed by future groundwater modeling. The first phase of the centralized AWPF would be designed to produce 5.3 mgd of purified recycled water. The centralized AWPF would be expanded in the future to supply additional water to the long-term potable reuse projects (i.e., Los Gatos recharge ponds GWR, Westside injection wells IPR, and potentially Central Pipeline DPR). The pipeline would be designed for the ultimate capacity so that there wouldn't be any

Figure 2-2: Long-Term Potable Reuse Project Concept


RWF
SVAWPC
Centralized AWPF
Phase 2 Design Capacity: 5 mgd
Phase 3 Design Capacity: 25 mgd
Phase 4 Design Capacity: 29 mgd
237
Phase 2
(3.2 Miles 42" Pipeline
4.4 Miles 18" Pipeline)
680
101
Phase 2
Mid-Basin Injection Wells
IPR Project
Phase 4 - Alternative 2
Central Pipeline
DPR Project
Central Pipeline
Phase 4 - Alternative 1
Westside Injection
Wells IPR Project
280
101
Phase 3
(11.3 Mile 36" Pipeline)
87
85
Phase 3
Los Gatos Recharge
Ponds IPR Project
Phase 1
Ford Recharge
Pond IPR Project
Rinconada
WTP
Legend
▲ San Jose/Santa Clara Regional Wastewater Facility (RWF)
▲ Proposed Advanced Water Purifcation Facility (AWPF)
▲ Silicon Valley Advanced Water Purification Center (SVAWPC)
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
■ Injection Well
● Injection Well System
Purified Recycled Water Pipeline - Phase 2
Purified Recycled Water Pipeline - Phase 3
Purified Recycled Water Pipeline - Phase 4
Raw Water Pipeline

3. Preliminary Hydrogeologic and Regulatory Evaluation

The preliminary hydrogeologic and regulatory requirements are highlighted for the near term temporary AWPF injection project introduced in Section 2.1. This near-term project concept includes construction of a satellite AWPF on a parcel owned by Santa Clara, which is the location of an existing idle groundwater production well. Purified recycled water would be produced at the site and injected into either the existing on-site idle production well or a new injection well to be constructed on the site. The

If the near-term project proves successful, it would support development of the long-term Mid Basin project including recharge of up to 5 mgd of purified recycled water in the Santa Clara Valley Subbasin (Subbasin). Successful operation of the near-term project could also support an increased initial RWC for

This preliminary evaluation is conducted to assess the feasibility of the near-term project from both hydrogeologic and regulatory perspectives.

3.1 Hydrogeologic Assessment

This hydrogeologic assessment considers the distance to nearby production wells and use of the existing idle production well for injection, aquifer characteristics, groundwater flow, and depth to groundwater (available storage capacity)

Site Location

Figure 3-1 shows the location of an existing idle groundwater production well owned by Santa Clara (Well 16-02) proposed as the potential injection well or site of a new injection well and other nearby

Production/Injection Wells

Production wells in the vicinity of the proposed injection site are owned by Santa Clara, San José, and the San José Water Company. There are no other water supply production wells in the vicinity of the proposed mid-basin injection project. There are other nearby groundwater remediation extraction wells; however, these wells are screened in the Shallow or Perched Aquifer and hydraulically separated from

Existing Potential Injection Well

Well 16-02 was drilled in 1969 and replaced an existing well on the site, which was destroyed due to failure of the well resulting from well collapse. Well completion information for Well 16-02 is presented

Figure 3-1: Near-term Project Location Map

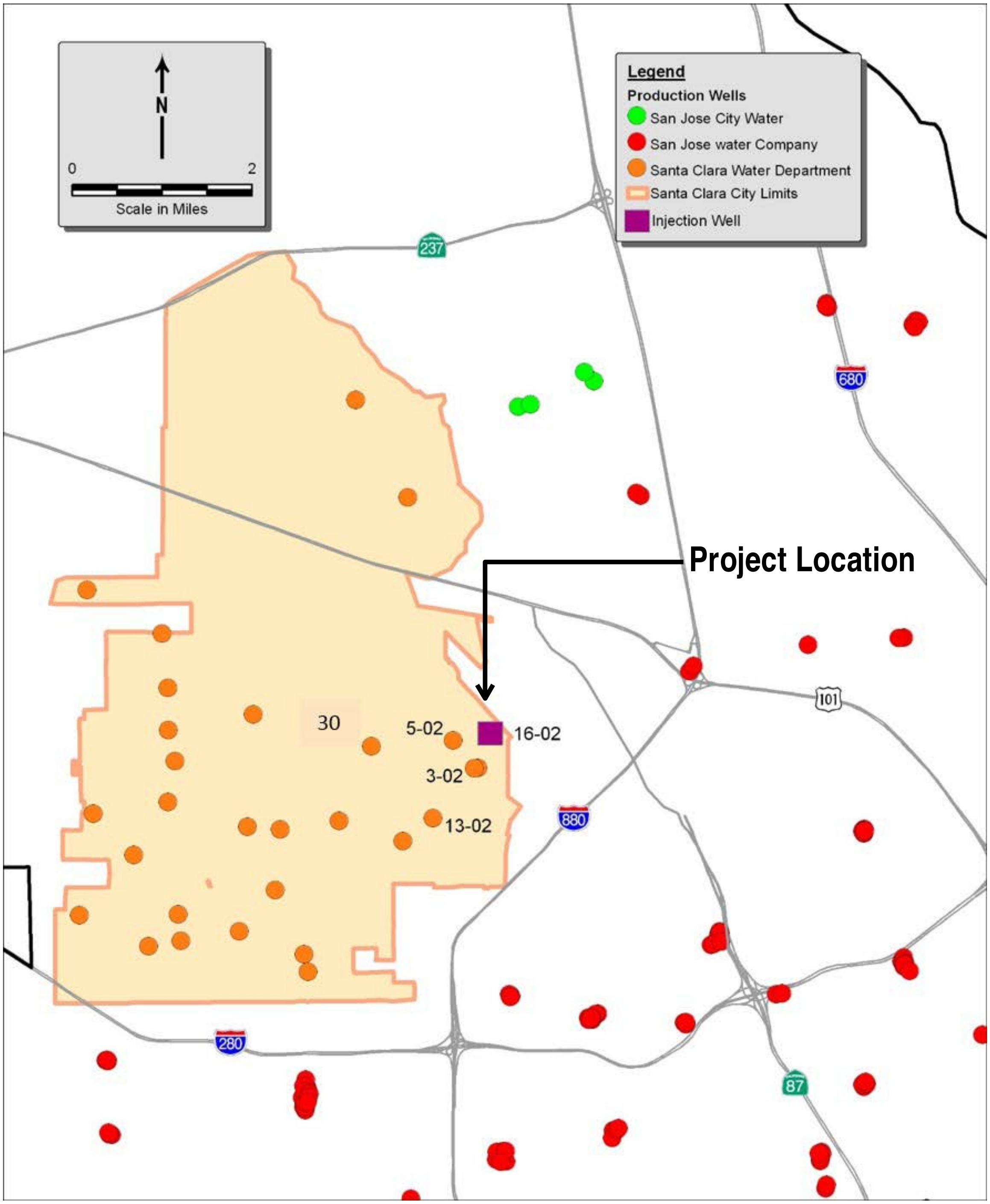


Table 3-1: Well 16-02 Well Completion and Production Information

Parameter	Description
Date Drilled	1969
Well Depth	900 feet
Casing Diameter	14 inches
Casing Material	¼ inch steel
Surface Seal and Conductor Casing	Yes
Perforated Interval	Intermittent from 570 to 880 feet below ground surface
Peak Production	1,093 gallons per minute (1998)

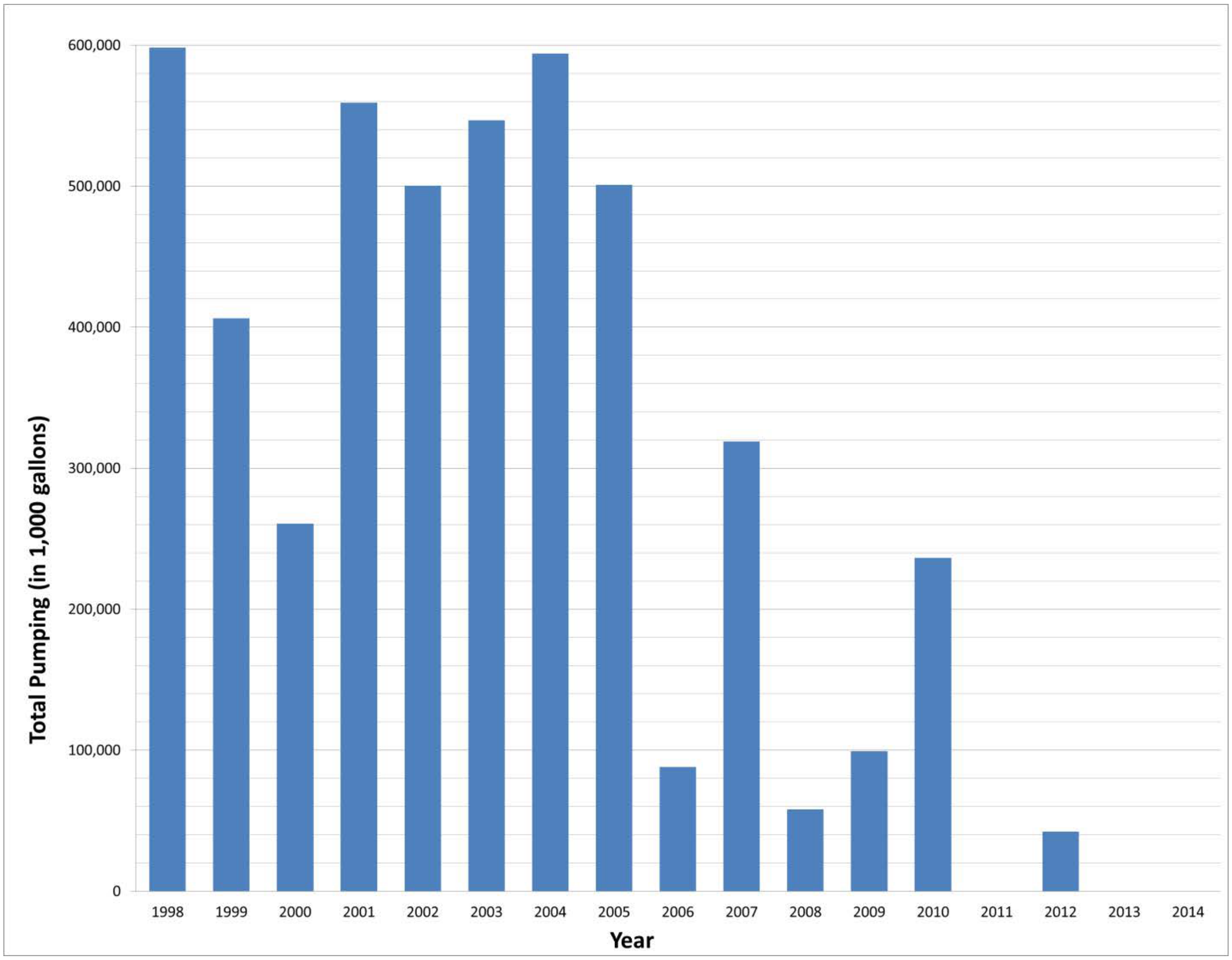
In 1986, a video log of the well was run to determine the cause of observed bacteria detections. The log noted two feet of oil on the water surface, water intrusion at a joint at 275 feet below ground surface (ft-bgs) and a swaged patch at 443 to 449 ft-bgs. A caliper log was also run and found an apparent reduction in the well casing inner diameter from 14 to 13 ¾ inches between 75 and 275 ft-bgs and an apparent casing failure at 275 ft-bgs. Records also indicate that Santa Clara swaged a liner at 275 ft-bgs, installed a new pump and motor, and redeveloped the well 1986. Possible sources of the bacteria and

Annual production in Well 16-02 between 1998 and 2014 is shown in Figure 3-2. Prior to 1998, production was not tracked by Santa Clara by individual well. For the period of record, the well had a peak production of about 600 million of gallons per year in 1998 (about 1,100 gallons per minute [gpm]). The production record shows variable production between 1998 and 2005 and declining production after 2005. Production essentially stopped in November 2010, except for a small amount of pumping in 2013. The peak production of about 1,100 gpm is equivalent to a capacity of approximately 1.6 mgd. Assuming Well 16-02 could be restored to its condition prior to 2005 and the target injection rate is

Given the documented well repairs and evidence of a bacterial contamination event, it is recommended the Well 16-02 be thoroughly inspected and tested to determine its suitability for injection. Assessment should include, at a minimum, video and caliper logging, water quality testing, and aquifer testing to assess the well integrity and injection rate capacity. Prior to the aquifer test, the well should be redeveloped to maximize yield. In addition, to use Well 16-02 for injection, information must be provided to the United States Environmental Protection Agency (USEPA) in accordance with the

Depending on the well testing results, it may be advisable to drill a new injection well on the site.

Figure 3-2: Annual Groundwater Production from Well 16-02 in 1,000 of Gallons



Stratigraphy

In simple terms, aquifers beneath the proposed injection site are comprised of a Shallow Aquifer, a continuous regional Bay Mud aquitard, and a deeper confined aquifer, referred to as the Principal Aquifer. Nonetheless, the unconsolidated sediments which comprise the aquifers, form a complex, multiple aquifer-aquitard system. Individual hydrogeologic units are typically thin and laterally discontinuous. This characterization is consistent with the electrical log of Well 16-02, which indicated

Most of the active production wells produce groundwater from the Principal Aquifer and are completed to depths typically ranging from 300 to 700 ft-bgs. In the area of the proposed injection site, the Principal Aquifer is fully confined by the regional aquitard (DWR, 1975). Recharge areas exist along the

Aquifer Hydraulic Properties

Hydraulic conductivity, effective porosity, and hydraulic gradient are parameters used to estimate travel time from the proposed injection well to nearby potable water supply production wells. The hydraulic conductivity in the vicinity of the proposed injection site is determined based on data presented in the Santa Clara Valley Groundwater Modeling documentation (CH2M Hill, 1992a and 1992b). The calibrated hydraulic conductivity used for modeling in the vicinity of Well 16-02 at the depth of the screened interval used is 55 feet per day (ft/d). This is consistent with aquifer test data for a well located south of

Groundwater Flow and Elevations

Figure 3-3 shows groundwater elevations in the vicinity of the proposed injection site in June 2014. Regionally, groundwater flows from the edges of the subbasin northward toward San Francisco Bay. However, groundwater pumping within Santa Clara results in local pumping depressions and the local groundwater flow direction is currently to the southwest as shown in Figure 3-3. The groundwater elevation in Well 16-02 in June 2014 was 18 feet below sea level. Assuming an injection mound of 20 feet would place the groundwater level at 2 feet above sea level. Based on this assumed injection mound and the June 2014 groundwater levels in the remaining wells, the hydraulic gradient between Wells 16-02 and 2-02 is calculated to be 0.009 foot/foot under injection conditions. Note that the actual

Figure 3-4 shows depth to groundwater in Well 16-02 and the three closest water supply wells for the period from 2005 to 2014. As shown in the figure, groundwater elevations fluctuate seasonally, with the greatest depth to water occurring in the late summer/early fall and the minimum depths to water occurring in the spring. Groundwater levels also exhibit long-term fluctuations reflecting patterns in precipitation and managed aquifer recharge. Groundwater levels are currently at a 10-year minimum as a result of the recent drought conditions, reduced managed aquifer recharge by the District, and

Figure 3-3: Groundwater Elevations in June 2014

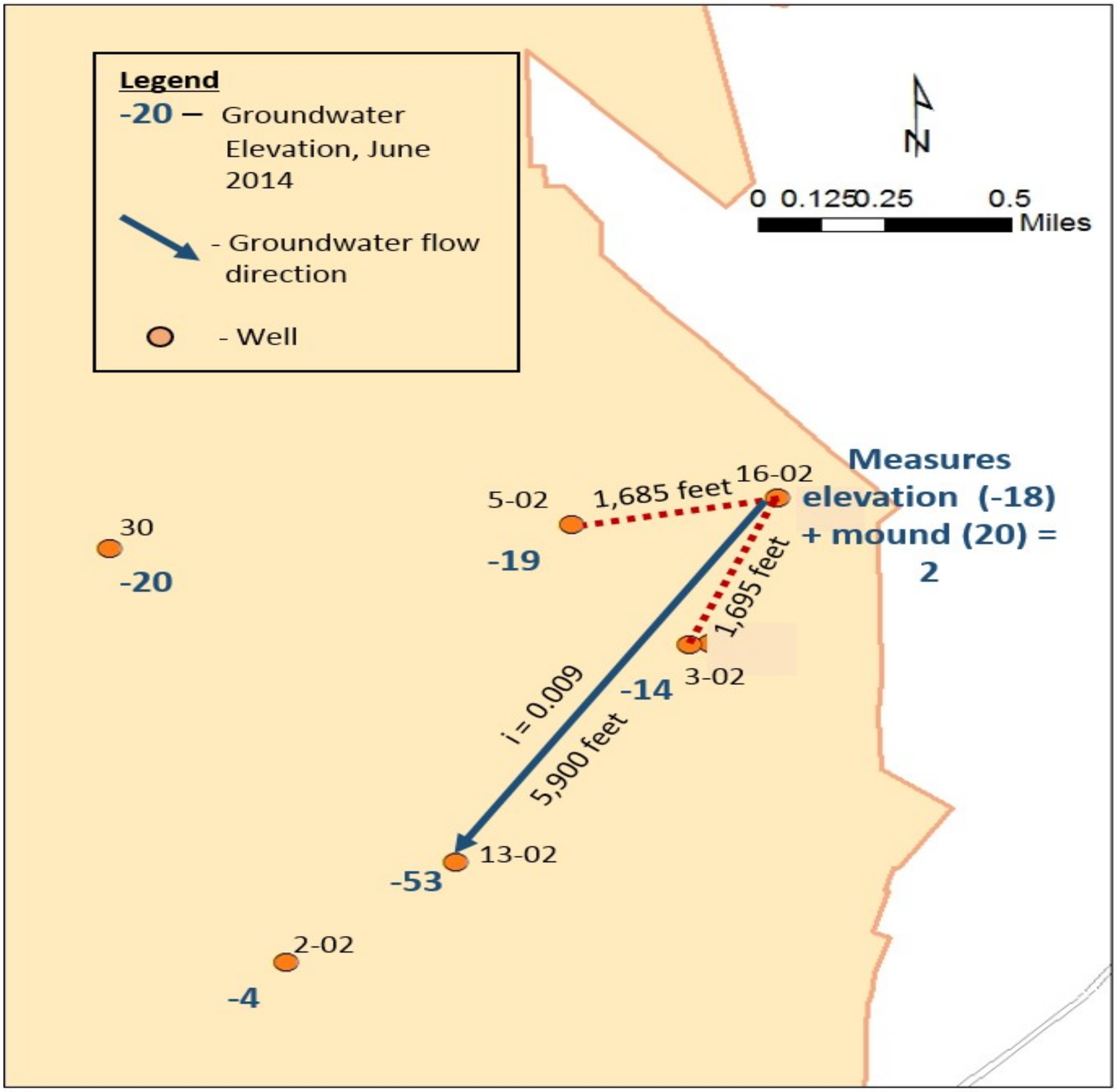
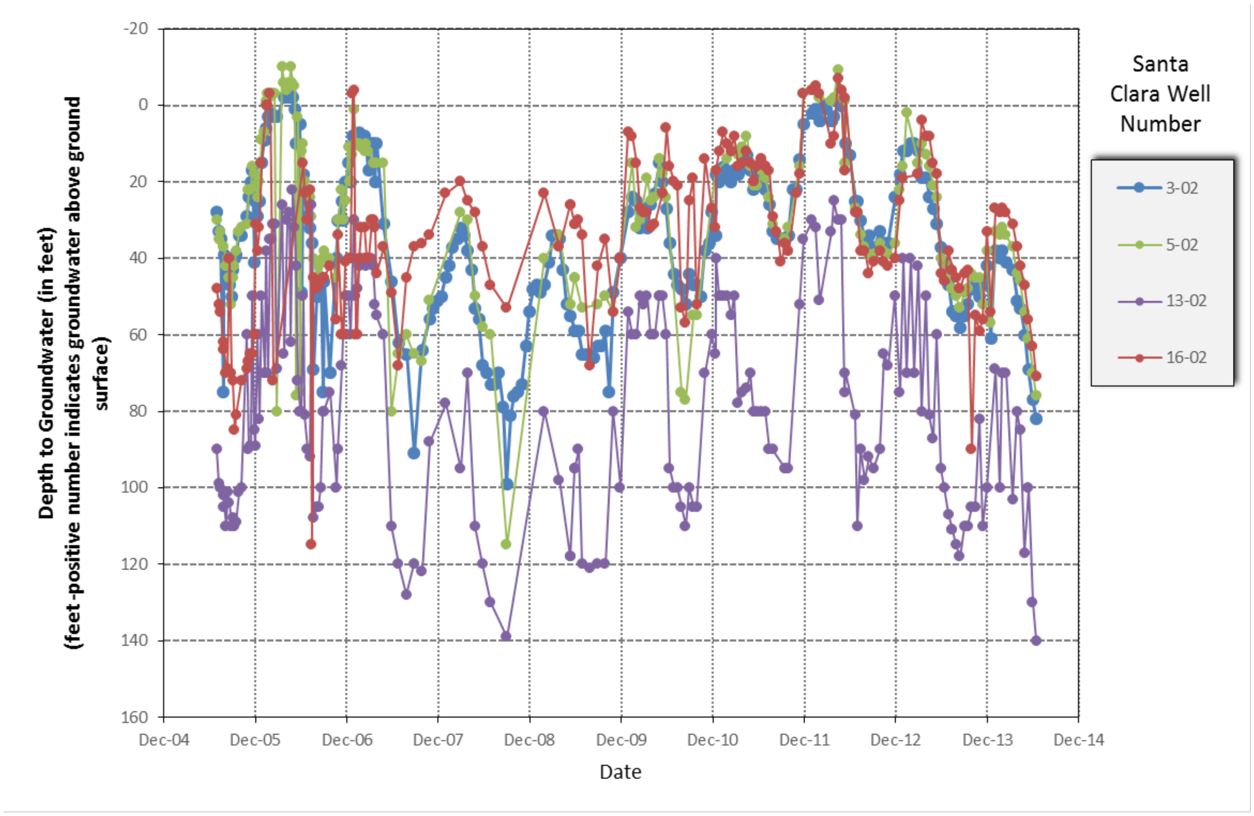


Figure 3-4: Depths to Groundwater



Groundwater levels near or above the ground surface have occurred over the past 10 years. This condition reduces the available storage capacity for injected recycled water. For a confined aquifer, the aquifer capacity was defined by the maximum wellhead pressure that the formation can withstand. Water injected into a confined aquifer is stored as increased pore pressure. As a result, there is a maximum additional pore pressure that a formation can tolerate before excess pressure begins to fracture the confining sediments and the injected water moves into the overlying soils. A formation can

$$\text{Maximum head rise} \cong 0.22 \times (A - D)$$

Where A = depth to the base of the confining unit and D = starting groundwater depth prior to injection.

Based on the observed depth to the base of the confining unit observed in Well 16-02 (110 ft-bgs) and an assumed starting groundwater level of 5 feet above the ground surface, the maximum permissible head rise is 23 feet. When groundwater levels are high due to increased precipitation and managed aquifer recharge, injection of purified recycled water may be limited. To reduce over-pressurizing the well, Santa Clara could potentially pump nearby supply wells at higher rates to lower local groundwater modeling would need to be conducted to simulate groundwater heads under future injection conditions and potential modified pumping scenarios.

Groundwater Quality

A review of SWRCB DDW water quality data available on the online at the GeoTracker GAMA website for the Well 16-02 and other nearby potable water supply wells indicates that groundwater quality is

When Well 16-02 was being drilled, depth discrete groundwater samples were collected and tested for total hardness, alkalinity, and chloride. The results of this testing are presented in Table 3-2. The testing showed that water at the shallower intervals had higher hardness levels and, as a result, the well was

Table 3-2: Depth Discrete Groundwater Sampling of Well 16-02 Borehole

Depth (ft-bgs)	Total Hardness (mg/L)	Total Alkalinity (mg/L)	Total Chlorides (mg/L)
320 to 390	340 (Poor Quality)	250	40
420 to 460	350 (Poor Quality)	260	40
560 to 600	200	200	30
690 to 740	120	180	25
Final Development	190	220	45

ft-bgs – feet below ground surface
mg/L – milligrams per liter

A Black & Veatch-Kennedy/Jenks (B&V–KJ) study conducted for the District (B&V, 2003) concluded that for direct injection, the requirement for advanced treatment significantly reduces most contaminant levels, and if RO is coupled with UV treatment in an advanced oxidation process (primarily to address disinfection by-products), direct injection would appear to have no negative impact to groundwater

For direct injection recharge, clogging of injection well screens, gravel envelopes, and surrounding aquifer media due to total suspended solids (TSS), biological growth, and chemical reactions can be a potential problem. However, because of the low nutrient and TSS concentrations of advanced purified water, biological growth and physical clogging due to particulate materials should be minimal. The possibility of soil aquifer plugging problems due to clay expansion/dispersion could exist if advanced treated water with very low total dissolved solids (TDS) is introduces to an aquifer with water of higher TDS. The 2003 B&V – K/J report recommended additional study of this issue. Typically, injection wells are periodically pumped or otherwise purged to remove fine-grained materials, biological growth, rates. Purged water can potentially be discharged to either the nearby sanitary sewer or storm drain system.

Changes in native groundwater quality can also result from geochemical reactions between recharge water and the aquifer matrix. For example, arsenic can be released by oxidation of interstitial pyrite by oxygenated recharge water. Arsenic mobilization has been observed at some (but not all) injection sites in marine limestone and some sandstone aquifer matrices (NGWA, 2014). This issue would need to be investigated prior to implementation of a near-term mid-basin project and a hydrogeochemical study

Another water quality consideration is the potential impact to existing groundwater contamination areas from the injection of recycled water. The mounding associated with recycled water injection can alter local groundwater flow patterns, which can then change the shape, migration direction, and transport rates of contamination plumes thus affecting remedial facilities. Because the proposed injection well site is located in the confined portion of the Subbasin and environmental release site contamination is typically limited to the Shallow Aquifer which does not typically impact the deeper Principal Aquifer where the water supply wells are screened, the injection of recycled water is not expected to impact any existing contamination. Additionally, a review of environmental release sites in

3.2 Division of Drinking Water Requirements

The State Water Resources Control Board (SWRCB), the Division of Drinking Water (DDW - formerly the California Department of Public Health [CDPH]) has developed the Groundwater Replenishment with Recycled Water regulations (GWR Regulations). The final GWR Regulations were adopted and went into effect on June 18, 2014 (SWRCB DDW, 2014). The GWR Regulations are organized by the type of project, including both (1) surface applications (surface spreading) and (2) subsurface applications (injection or vadose zone wells). A summary of the key provisions in the GWR Regulations for subsurface application

The GWR regulations require that water used for recharge achieve at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment barriers. For each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than 1-log reduction. Often, the final reduction is achieved within the aquifer, after injection or percolation, based on travel time credits of 1-log per each 1-month travel time for virus up to a maximum of 6-log credits. The needed travel time underground to achieve the required pathogen

Table 3-3: DDW Regulations for Subsurface Application of Recycled Water

	Subsurface Application
Treatment	Full advanced treatment including RO and advanced oxidation process applied to the full recycled water volume
Total Organic Carbon (TOC)	Recycled water TOC = 0.5 mg/L
Response retention time (RRT)	Minimum time that recycled water would be retained underground to allow the project sponsor to respond to a treatment failure. Minimum of RRT of 2 months, but must be justified by the project sponsor. The RRT must be validated using an added tracer or DDW-approved
Pathogen reduction time	Time required for recycled water to be retained underground to meet virus reduction requirement; for each month underground, 1-log virus reduction credited
RWC	The RWC can be defined by volume and TOC. The recycled water applied at the GWR Project ÷ (recycled water + credited dilution water). The Initial RWC_{min} can be = 0.5 mg/L ÷ the maximum TOC
Initial RWC_{max}	Based on DDW review of the Engineering Report and information obtained as a result of the public hearing Can range from 20% up to 100%
Increased RWC_{max}	Up to 100% subject to additional requirements: 1) Updated Engineering Report and Operations Plan 2) Approval by DDW and RWQCB and RWQCB permit 3) For the previous 52 weeks, the TOC 20-week running average has not exceeded 0.5 mg/L
Dilution water compliance calculation	Based on 120-month running average

Subsurface Application	
Groundwater monitoring	At least two monitoring wells downgradient of the injection well(s). 1) One monitoring well must be located between two weeks to six months travel time and at least 30 days upgradient of the nearest drinking water well; and 2) One monitoring well must be located between the injection well(s) and the nearest downgradient drinking water well. The monitoring wells must allow for samples to be obtained
Engineering Report	Proposed recycled water recharge project require submittal of an Engineering Report to DDW.

The GWR regulations also include provisions for the determination of a Response Retention Time (RRT), which is the time recycled water must be retained underground between recharge and extraction to allow a project sponsor ample time to identify treatment failures and implement appropriate actions to protect public health from inadequately treated recycled water or recharge water. The minimum RRT allowed is 2 months, but the proposed RRT must be approved by the SWRCB DDW. Based on other approved projects, the RRT is often measured in months. For example, the RRT for the Alamitos Gap and Dominguez Gap Seawater Intrusion Barriers, which have been approved to inject 100 percent RWC, both

Under the GWR regulations, the pathogen reduction time and RRT can be demonstrated for planning purposed by analytical analysis such as Darcy's Law calculations or groundwater flow modeling. Because of inherent uncertainties in these methods, travel times calculated with a Darcy calculation are divided by 4 and travel times estimated with a groundwater flow model are divided by 2, for project planning purposes. So for example, if the greater of the RRT and pathogen reduction time is six months, a Darcy calculation would need to demonstrate a minimum of two years travel time to the nearest potable water supply well while a groundwater flow model would need to demonstrate a one year travel time.

The regulations do not specify the initial maximum RWC to the aquifer for subsurface injection. The initial RWC must be approved by DDW based on the DDW's review of the project's Engineering Report and other information obtained as a result of the public hearing. The project sponsor must demonstrate that the treatment processes preceding the soil-aquifer treatment process can reliably achieve a TOC 20-week running average no greater than 0.5 mg/L. The remainder of the water that replenishes the groundwater subbasin should come from non-recycled water sources, which can include surface influence. These water sources are referred to as “diluent” water. The recycled water divided by the sum of the recycled water and diluents water is referred to as the RWC.

Ultimately, a RWC of 100 percent can be achieved for a recharge project utilizing fully advanced treated (MF/RO/AOP) recycled water, eliminating the need for diluent water. As examples, the three seawater intrusion barriers in Los Angeles County have received approval to move to 100 percent RWC and the Orange County Water District (OCWDs) has received approval to start an injection project at 100 percent RWC. A greater initial RWC of (75 percent rather than a maximum of 50 percent permissible at the time) was allowed for OCWD based on OCWDs demonstrated experience with recycled water recharge

Travel Time to Nearest Water Supply Wells

The Darcy’s law equation was used to estimate groundwater velocities and travel time from the proposed Santa Clara injection well site to the nearest water supply wells. Darcy's law is the basic

$$v = -K(\Delta h/\Delta l)/n$$

where v = average linear velocity in feet per day, K = hydraulic conductivity in feet per day, $\Delta h/\Delta l$ = hydraulic gradient in foot/foot (h = head and l = distance), and n = effective porosity in percent.

As noted above, because of uncertainties associated with the Darcy equation parameters, DDW requires the application of a safety factor of four to the travel time estimate. Figure 3-3 above shows ground water elevations in June 2014 in wells in the vicinity of the proposed injection well site and an assumed injection mound of 20 feet above the static water level. The June 2014 groundwater levels and assumed mound indicate a hydraulic gradient of 0.009 foot/foot between Wells 16-02 and 13-02. Using a hydraulic conductivity of 55 ft/d, an effective porosity of 0.15, and a hydraulic gradient of 0.009 yields a

Based on the calculated velocity of 3.3 ft/d, the estimated travel time to the two closest potable water supply wells (Wells 3-02 and 5-02) is about 16.5 months. With the DDW-required method correction, this yields a modified travel time of 4.1 months. Based on the range of typical RRT and pathogen reduction travel time for other recycled water injection sites, these preliminary calculations indicate that recycled water injection in the vicinity of Well 16-02 could potentially meet the GWR regulatory criteria. A more technically-rigorous estimate will be provided when the groundwater flow modeling is

Diluent Water

While DDW has allowed advanced treated recycled water recharge projects to move to a 100 percent RWC over time based on successful operation, diluent water is initially required to blend with the recycled water. Blending can be done before or after injection. Therefore, it is possible that the near-term, temporary mid-basin project could be approved at an initial 100 percent RWC after successful native groundwater flowing through the zone of influence of recharged recycled water for other recycled water recharge projects so blending with potable water prior to injection isn't required.

A preliminary estimate of the volume of native groundwater flowing through the estimated recycled water zone of influence for the mid-basin project was made using the Darcy equation. Darcy's Law states that:

$$QQ = KK \times MM \times AA$$

where Q = flow, K = hydraulic conductivity of the aquifer, i = hydraulic gradient, and A = cross sectional area of the aquifer perpendicular to the direction of the flow.

Using the hydraulic conductivity of 55 ft/d, a hydraulic gradient of 0.009, and a cross sectional area of approximately 680,000 square feet (ft^2), the Darcy equation yields a flow of 299,200 cubic feet per day (ft^3/d) or 2.2 mgd. The cross section area used in the equation assumes a cross sectional length of 2,000 feet (based on the size of pumping depressions around nearby production wells) and assumes that the recycled water would spread out in a mound of approximately that size and with a vertical length of 340 feet, which is the total thickness of permeable units identified by electrical logging of the Well 16-02 borehole. Based on this calculation the native groundwater flowing through the injected recycled water

Groundwater flow modeling is recommended to provide a more technically-rigorous estimate of the percentage of recycled water in nearby water supply wells. According to the DDW GWR Regulations, the initial maximum RWC for the project would be based on the DDW's review of the project Engineering

Monitoring Wells

Locations and construction details for monitoring wells would be developed after modeling is conducted to better simulated groundwater flow and travel times under proposed project operations.

Engineering Report

The numerous requirements for the Engineering Report for a recycled water groundwater replenishment reuse project are described in the GWR Regulations (SWRCB DDW, 2014). This TM is not intended to fulfill the DDW requirements for an Engineering Report. Rather, this TM is intended to provide a preliminary feasibility assessment of the near-term, temporary mid-basin project, specifically focused on whether estimated travel times to the nearest potable water supply wells would likely meet

3.3 Regional Water Quality Control Board

The San Francisco RWQCB regulates groundwater replenishment projects in the San Francisco Bay Area under numerous state laws and regulations, including the Water Quality Control Plan (Basin Plan) (December 31, 2011) and SWRCB Policies. The Basin Plan requirements include designated uses and groundwater objectives using both numeric and narrative requirements to protect those uses. The Basin Plan also applies the state's Anti-degradation Policy, which is further interpreted pursuant to the

The near-term and long-term mid-basin injection project would necessitate issuance of Waste Discharge and Water Recycling Requirements (WDRs/WRRs) by the San Francisco Region RWQCB. The WDRs/WRRs would establish monitoring and reporting requirements

3.4 Underground Injection Control

Under existing federal regulations for the Underground Injection Control (UIC) program, injection wells (such as the existing Well 16-02 or a potential new injection well) are "authorized by rule," which means they do not require a permit from the USEPA if they do not endanger underground sources of drinking water and comply with other UIC program requirements. For California, USEPA Region 9 is the permitting administrator for Class V wells (wells that are used to inject non-hazardous fluids underground). Any injection project planned in California must meet the Sources of Drinking Water Policy[1] which ensures protection of groundwater quality for drinking water supplies; thus, a Federal

3.5 Planned Groundwater Flow Modeling

The District has a calibrated MODFLOW groundwater flow model of the Santa Clara Subbasin (CH2M Hill, 1992). The District staff may need to refine the flow model to create a local-scale groundwater model. The local scale groundwater model could be used to simulate recycled water injection and groundwater extraction from existing production wells in the area. The model would also be used to estimate travel time to and the percentage of recycled water extracted from nearby production wells in

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[1] State Water Resources Control Board Resolution No. 88-63, as amended by Resolution No. 2006-0008.

3.6 Conclusions

Based on this preliminary analysis, the proposed near-term AWPF recycled water injection project appears feasible and a 1-mgd injection project can likely meet DDW GWR regulatory requirements. Note that several assumptions have been made in conducting the preliminary Darcy calculations and additional groundwater modeling is proposed to refine estimates presented here and provide a more technically-rigorous analysis of travel time and dilution provided by native groundwater flowing through

Prior to moving forward with the project, additional analysis of potential water quality impacts will need to be addressed including:

1. The potential for contamination mobilization due to geochemical reactions between injected purified water and native groundwater, and
2. The potential for soil aquifer plugging or water quality degradation due to differences in

4. Preliminary Project Description

This section includes a description of the near-term 1-mgd satellite AWPF as well as a preliminary site layout of the AWPF and injection well facilities.

4.1 Existing Conditions

As stated above, the proposed site for the satellite AWPF is the currently site of an existing, idle groundwater production Well 16-02 owned by the City of Santa Clara. The parcel is located at the northwest intersection of Coleman Avenue and Brokaw Road and is approximately 0.15 acres. The site is [illegible] sand separator equipment, a chlorination system, piping, and appurtenances. See Figure 4-1 and Figure 4-2 for existing equipment and piping layout at Well 16-02.

Figure 4-1: Groundwater Production Well 16-02

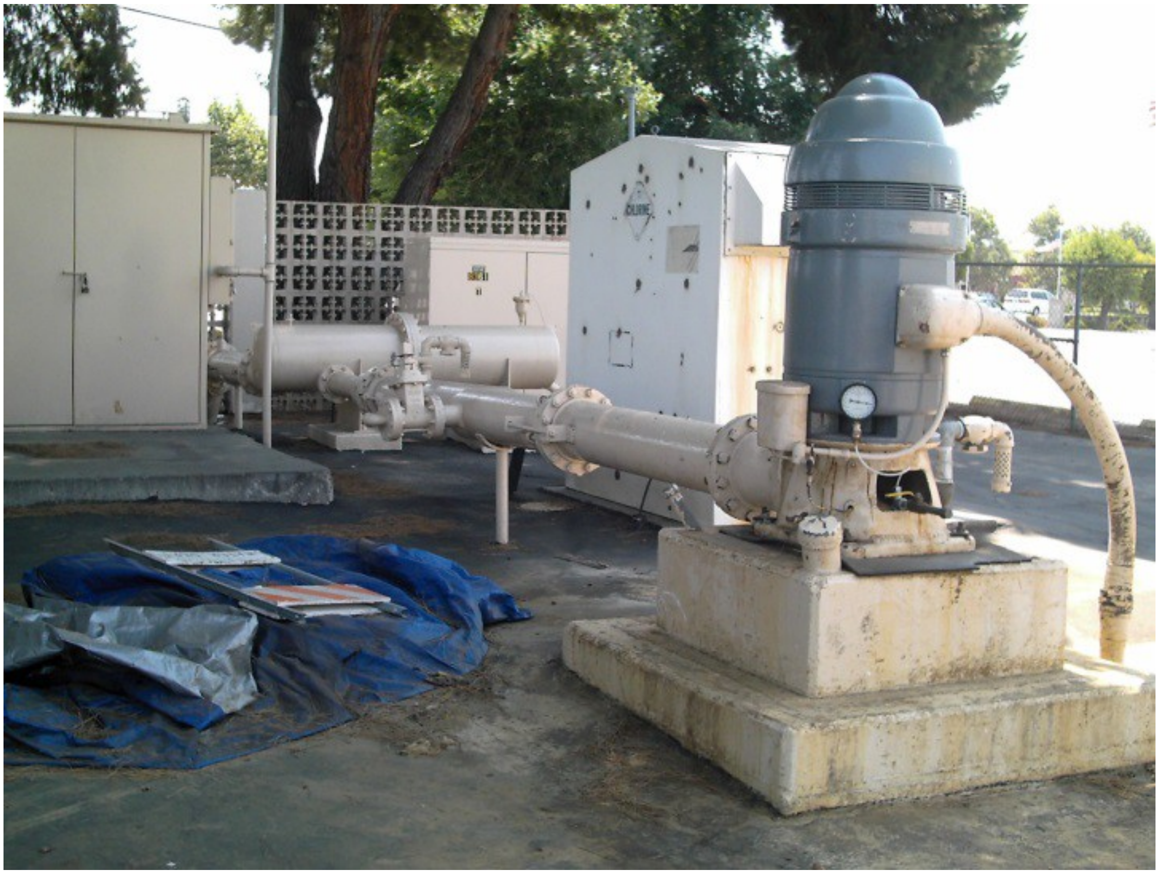
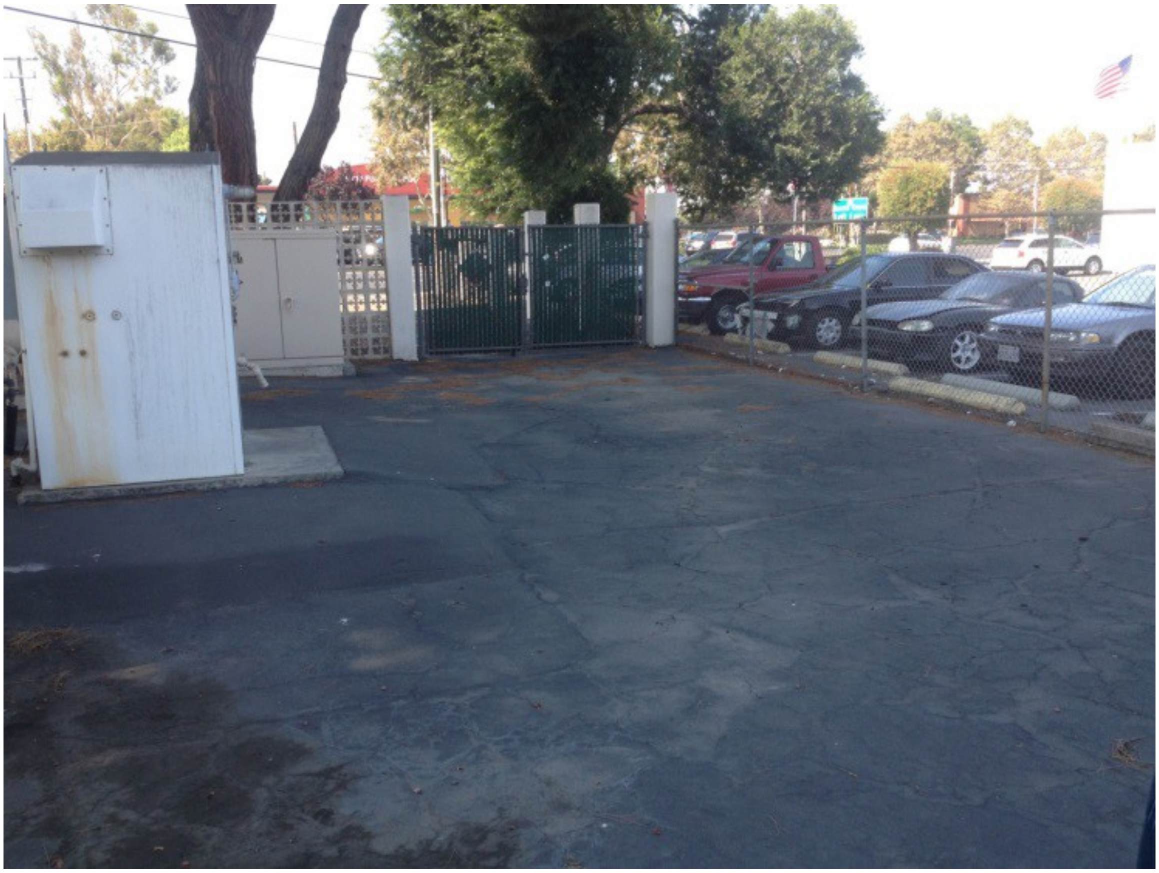


Figure 4-2: Well 16-02 Site Facing Coleman Avenue



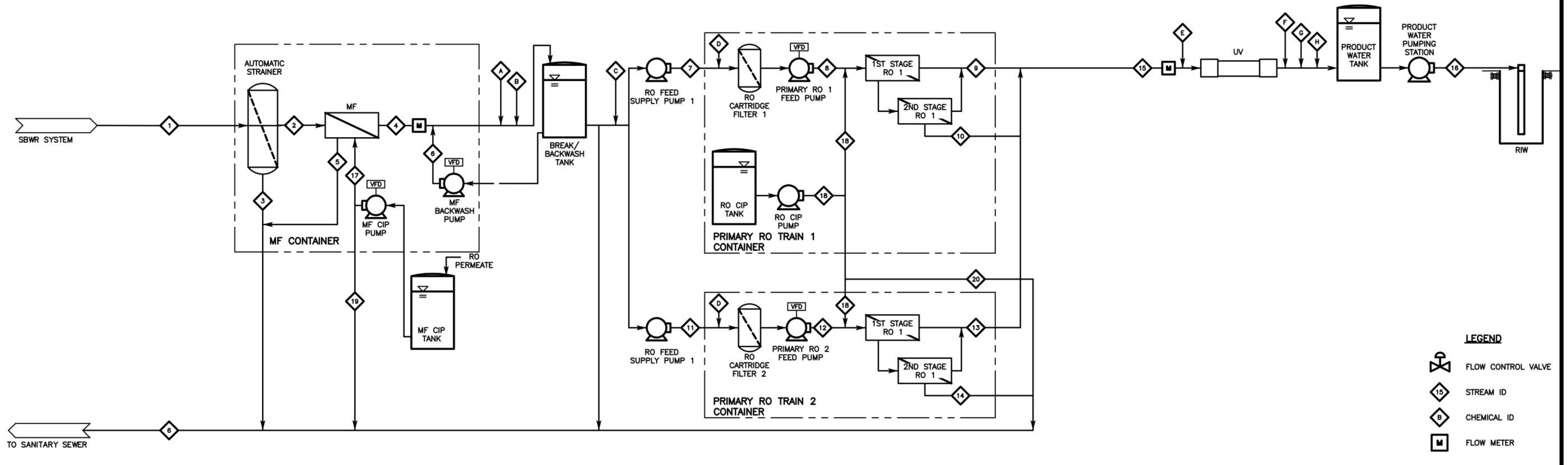
The site is bordered on the west and north sides by an asphalt parking lot and driveway that serves the neighboring commercial businesses. The equipment is secured by a combination of chain-link and breeze block fences. An existing driveway and gated access is available from both Coleman Avenue and

The SBWR system extends to this area in the form of a 20-inch recycled water pipeline along Coleman Avenue (see Figure 2-1). The pressure in this SBWR zone (Zone 1) is approximately 65 to 80 pounds per square inch (psi). There is also a 21-inch diameter sewer located in Coleman Avenue that is anticipated to have sufficient capacity for the 0.24 mgd of residuals, which would include MF backwash (intermittent) and RO concentrate (continuous). The capacity in the sewer needs to be assessed in more

4.2 Process Descriptions and Preliminary Design Criteria

The satellite AWPF would include multiple unit processes, including MF, RO, advanced oxidation with UV and hydrogen peroxide, chlorination, and product water stabilization. Since the AWPF is a temporary facility, the equipment would be pre-packaged and mounted in shipping containers for each of the

Figure 4-3: Preliminary Process Flow Diagram



FLOW STREAM
1. AWPF FEED
2. MF FEED
3. AUTOMATIC STRAINER WASTE
4. MF FILTRATE
5. MF BACKWASH WASTE
6. MF BACKWASH FEED
7. COMBINED RO 1 FEED
8. PRIMARY RO 1 FEED
9. PRIMARY RO 1 PERMEATE
10. PRIMARY RO 1 CONCENTRATE
11. COMBINED RO 2 FEED
12. PRIMARY RO 2 FEED
13. PRIMARY RO 2 PERMEATE
14. PRIMARY RO 2 CONCENTRATE
15. COMBINED RO PERMEATE
16. PRODUCT WATER TO RECHARGE INJECTION WELL (RIW)
17. MF CIP FEED
18. RO CIP FEED
19. MF CIP WASTE
20. RO CIP WASTE

CHEMICAL STREAM ID
A. AQUEOUS AMMONIA
B. SODIUM HYPOCHLORITE
C. SULFURIC ACID
D. THRESHOLD INHIBITOR
E. HYDROGEN PEROXIDE
F. SODIUM HYPOCHLORITE
G. CALCIUM CHLORIDE
H. SODIUM HYDROXIDE

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Table 4-1 summarizes the anticipated recoveries, waste flows, and treatment process capacities for the MF and RO systems required to meet the target flow of 1 mgd.

Table 4-1: AWPF Preliminary Process Design Capacities

Parameter	Criteria
MF Recovery Rate	95%
RO Recovery Rate	85%
Influent to AWPF	1.24 mgd
MF Filtrate Water Capacity	1.18 mgd
RO Permeate Water Capacity	1.00 mgd
MF Backwash Waste	0.06 mgd
RO Concentrate	0.18 mgd

MF System

The MF (microfiltration or ultrafiltration) system would provide pretreatment for the RO system to reduce the particulate and biological fouling of the RO membranes. The MF system would effectively remove inert particulates, organic particulates, colloidal particulates, pathogenic organisms, bacteria,

As mentioned in Section 4.1, the incoming feed pressure from the SBWR system at this location is approximately 65 to 80 psi, which is a sufficient pressure to operate the MF system. Therefore, no influent tank or MF feed pumps would be provided. A feed control valve would be provided instead to

Table 4-2 provides presents the MF water quality goals.

Table 4-2: Membrane Filtration Water Quality Goals

Constituent	Design Criteria
Suspended Solids	Undetectable[1]
Filtrate Turbidity	<0.2 NTU (95th percentile) 0.5 NTU (all times)
Filtrate Silt Density Index (SDI)	<3

Notes:

1. EPA Method 160.2 Method Detection Limit is 1.0 mg/L, so goal is to be <1.0 mg/L.

The MF system would be comprised of chemical addition, strainers, membranes, and break tank. Table 4-3 presents design criteria for the MF system. A short description of the MF system equipment follows:

- **Chemical addition** – Ammonium hydroxide and sodium hypochlorite would be added upstream of the strainers for chloramination to control the biological fouling of the membranes.
- **Strainers** – The strainers immediately upstream of the membrane system protects the

- **Membranes** – The MF system would be housed in a container utilizing an open platform configuration that can accommodate the installation of membranes from multiple different suppliers. Appendix B shows an example container layout used for a similar AWPF project. The system would be fully automated for flow control, backwashing, daily maintenance cleans, and periodic chemical cleans in place (CIP). To prevent excessive accumulation of particles on the membrane surface, membrane backwashes would be performed every 25 to 30 minutes.
- **Break tank** – The tank would serve as a flow equalization reservoir for the MF filtrate prior to being supplied to the RO system. The break tank would mitigate the impact of the variations in the MF permeate flow (resulting from backwashes, cleanings, and integrity tests), by providing

Table 4-3: Conceptual MF System Design Criteria

Facility	Design Criteria
Strainers	
Type	0.3 mm Automatic Backwashing Strainer
Strainer recovery	99%
Membranes	
System capacity	1.24 mgd (860 gpm)
Feed pressure	10 to 30
Recovery	95%
Flux	33 gfd
Nominal pore size	0.01 micron
Material	PVDF
Fiber-flow path	Outside-in
Operating conditions	
Backwash interval	25 -30 mins
Backwash duration	2 mins
CIP frequency	30 days
Break tank	
Number of tanks	1
Volume	10,000 gal
Residence time	15 mins
Material	HDPE

RO System

While RO is used for purification and desalination in water treatment, it also has an extensive history of being effectively utilized in wastewater treatment processes for removal of a wide array of dissolved constituents, including trace organic compounds that are not removed through a tertiary filtration process. RO has been proven to be effective at removing the refractory organics and volatile organic fractions of dissolved organic constituents. RO is generally recognized as the best available treatment for reducing TDS and many constituents of emerging concern in wastewater effluent intended for indirect potable reuse. The RO system is comprised of RO feed supply pump, chemical addition, cartridge filters,

- **RO feed supply pump** – This pump would convey MF filtrate from the break tank through the RO cartridge filters to the RO feed pumps.
- **Chemical addition** – Antiscalant would be added upstream of the RO cartridge filters to control scaling of the RO membranes. Sulfuric acid would be added to lower the pH of the RO feed water to prevent calcium carbonate and calcium phosphate from limiting the RO recovery.
- **Cartridge filters** – The cartridge filters protect the RO membranes from particulates that may be introduced to the MF permeate in the break tank and through chemical addition.
- **RO feed pumps** – Each primary RO train would be paired with a dedicated feed pump. The pump dynamic head is a function of the incoming pressure from the RO feed supply pump, the headloss in the cartridge filters upstream and associated piping, and the required feed pressure to the RO system. The dynamic head will vary depending on changes in the water quality, the extent of RO membrane fouling, and the RO membrane age. A variable frequency drive (VFD) would be installed with the feed pumps in order to accommodate the varying head conditions.
- **RO trains** – A two-stage RO configuration would be provided with a target recovery rate of 85 percent. Eight-inch elements, which are the most common size in the IPR industry to date,

Membrane integrity would be monitored continuously through conductivity and measured in the feed and permeate of each of the primary RO systems. The RO skid conceptual design is based on a flux rate of 12 gpd. Table 4-4 summarizes the RO system design criteria.

Table 4-4: Conceptual RO System Design Criteria

Facility	Design Criteria
RO feed supply pump	
Type	Centrifugal
Pump capacity	1.18 mgd (818 gpm)
Drive	Constant speed
Cartridge Filters	
Type	5 micron string wound
Number of filters	2
Pump capacity	0.59 mgd (409 gpm)
RO feed pump	
Type	Centrifugal
Number of pumps	2
Pump capacity	0.59 mgd (409 gpm)
Drive	VFD
Membranes	
System capacity	1.18 mgd (818 gpm)
Average flux	12 gfd
Recovery	85%
Material	Composite Polyamide
Configurations	Spiral Wound
Nominal diameter	8 in
Standard salt rejection	99.2 (99.0 minimum)

UV Disinfection and Advanced Oxidation

The final AWPF treatment process is disinfection and advanced oxidation, which is required for IPR projects with subsurface application. A disinfection process is needed to meet the pathogenic microorganism reduction requirements included in the 2014 GWR Regulations. The GWR Regulations include specific criteria for advanced oxidation performance to address constituents not well removed by RO, due to their low molecular weight and low ionic charge. While some of these constituents, such as N-Nitrosodimethylamine (NDMA), are light sensitive and can be removed by UV without advanced oxidation, others, such as 1,4-dioxane and other contaminants of emerging concern (CECs), may require

The UV reactors have a dual purpose: disinfection and advanced oxidation with the addition of hydrogen peroxide upstream. The UV disinfection process would provide up to a 6-log enteric virus reduction (toward overall requirement of 12-log removal), a 6-log Giardia cyst reduction (toward overall requirement of 10-log removal), and a 6-log Cryptosporiudim oocyst reduction (toward overall requirement of 10-log removal)

The UV/peroxide system is the most common advanced oxidation technology for IPR and has been used extensively for the removal of trace organic compounds found in treated water. This AOP technology is recommended for this near-term project to allow the District to complete implementation in a short-time frame. Since UV/peroxide is proven in the potable reuse industry, this AOP approach is assumed to allow for the most straightforward and timely implementation. The District can consider pilot testing alternative AOP approaches, such as ozone-peroxide or UV-chlorine, at the temporary facility for potential use at the centralized AWPF included in the long-term potable reuse plan. See Appendix B for a sample layout of a similar UV/peroxide system. At the San Diego IPR Demonstration Facility, the UV/peroxide unit was successfully tested to demonstrate 0.5-log destruction of 1,4-dioxane at a flow

Post-Treatment Systems

Product water would be pumped to the injection well located at the existing idle production well site. Product water quality must minimize corrosion of the product water pump station and conveyance pipeline. Therefore, product water stabilization would be required. Product water stabilization is often achieved by adding caustic soda (to increase pH) and calcium chloride (to increase hardness). This strategy would allow operators to control hardness and pH independently, producing stable product

Table 4-5: Purified Recycled Water Post-Treatment⁄Stabilization Targets

Facility	Design Criteria
pH	6.5 – 9.0
Langelier Saturation Index (LSI)	-1.0 to 1.0

Waste Discharge

Major waste streams for the satellite AWPF include MF backwash waste, RO concentrate, and miscellaneous cleaning and analytical waste. All waste streams would be disposed by gravity flow to the

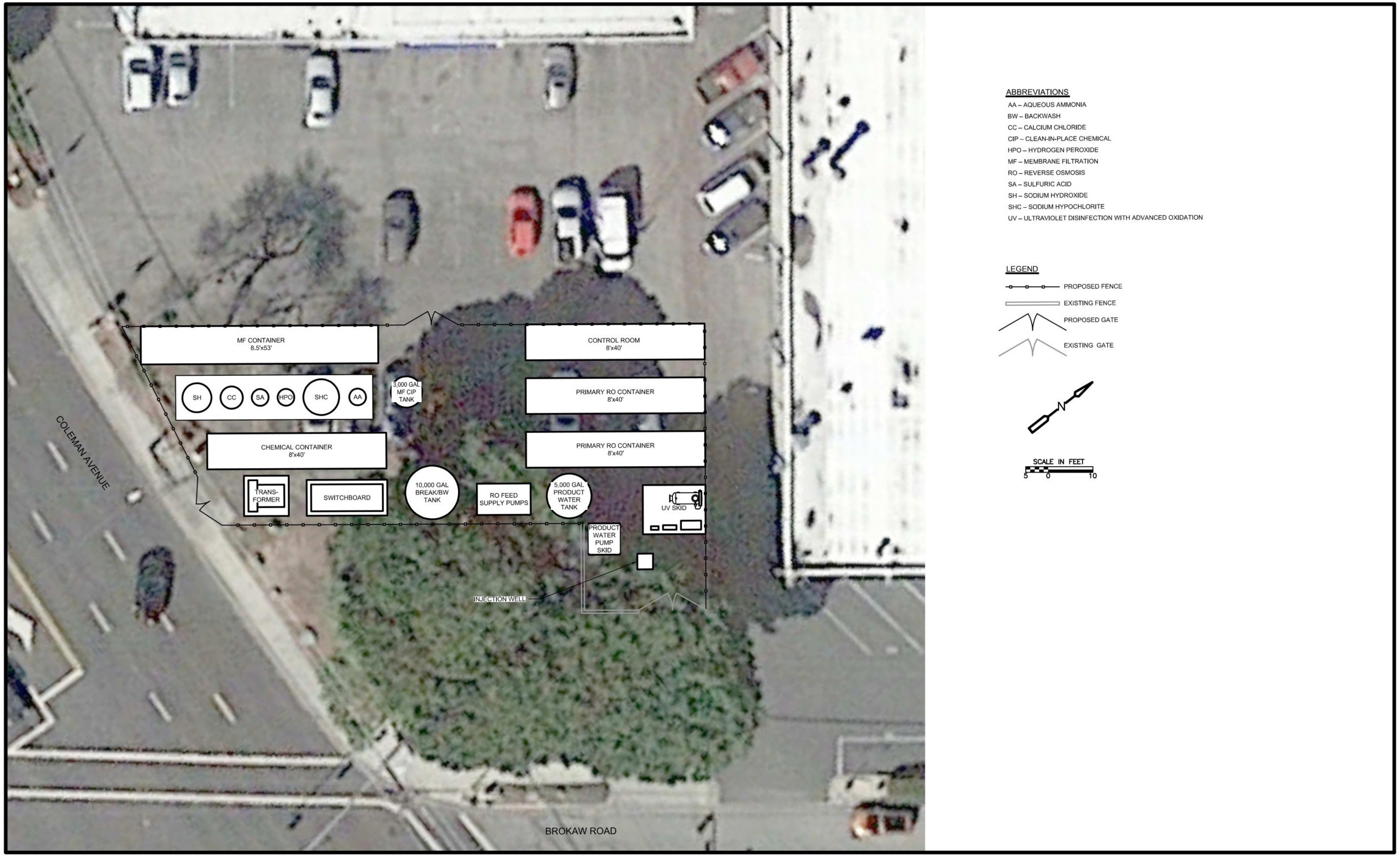
4.3 Preliminary Site Layout

Figure 4-4 shows the preliminary site layout for the satellite AWPF. Dimensions of respective containers or trailers, tanks, and equipment are based on a similar sized project that used a container design similar to the component drawings provided in Appendix B. The overall area required for all the pre-packaged trailers and equipment/tanks is approximately 0.13 acres. While the City's parcel is 0.15 acres in size, the preservation of the three existing trees would require additional property to be leased or purchased in order to accommodate the satellite AWPF. It is estimated that an additional 0.08 acres of the adjacent

As mentioned in Section 3.1, the existing idle groundwater production well may be repurposed as an injection well in order recharge the AWPF product water into the basin. Depending on the well testing results, it may be advisable to construct a new injection well on the site if damage to the existing well is found. Should a new injection well be required, the well can be drilled at approximately 10 to 20 feet away from the existing well and previously destroyed well (location presently undetermined). The site

Construction of the AWPF would also require the demolition of the existing well head equipment and piping. One existing gate would have to be removed in addition to the chain-link fence on the west side of the property. The breeze block wall and existing landscaping would be protected in place as much as

Figure 4-4: Preliminary Site Layout



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Since the site is currently paved, some repaving and surface patchwork would be required to prepare the site after the initial demolition. Concrete slab-on-grade and concrete pads would be installed to ensure that flat foundations are in place for the equipment trailers/containers, pumping skids, and

According to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPP) C.3 Stormwater Handbook (SCVURPPP 2012), if the project is located on a previously developed site and would add or replace impervious surface, it is considered a redevelopment project and is subject to the

- Projects that replace 50 percent or less of existing impervious surface need to treat stormwater runoff only from the portion of the site that is redeveloped. Projects that replace more than 50 percent of the existing impervious surface are required to treat runoff from the entire site.
- A project that does not increase the total amount of impervious surface over the pre-project

Based on these criteria and depending on the actual amount of pavement replacement required, minimal stormwater runoff treatment may have to be implemented for the project prior to connecting to the existing stormwater management system on the property.

Connection to the SBWR recycled water system for AWPF feed water would be made off the existing 20-inch ductile iron pipeline on Coleman Avenue (see Figure 2-1). To maintain a pipe flow velocity between 5 fps and 7 fps for the delivery of 1.24 mgd (see Table 4-1), an 8-inch connector pipeline would be provided. For disposal of waste streams, a 4-inch drain line would connect to the nearby sanitary sewer manhole on Coleman Avenue Road. Requirements to connect the AWPF to the sanitary sewer system

Power for the satellite AWPF would be obtained from a Silicon Valley Power (SVP) supplied pad mount transformer. SVP is responsible for getting primary power to the transformer and supplying and setting the transformer. SVP would determine the location of the utility connection point and make the connection. The project would be required run the service lateral to this point. Any relocation of existing

5. Permitting

This section provides an overview of additional permitting considerations for the near-term 1-mgd satellite AWPF.

5.1 Pathogen Removal Credits

Section 3.2 provided an overview of the DDW GWR regulations. One of the key regulatory requirements is the pathogen control log reduction credits for *Giardia*, *Cryptospordium*, and viruses using muliple treatment barriers. To date, DDW has only approved pathogen reduction credits for the expanded Vander Lans Advanced Water Treatment Facility that supplies recycled water for the Alamitos Barrier and the Cambria Emergency Water Supply project. Based on those reduction credits from wastewater treatment, advanced treatment, and underground residence time; and based on reduction credits

Table 5-1: Pathogen Log Removal Credits

Pathogen	DDW Require-ments	Primary/ Secondary^1	Title 22 Treatment (Tertiary Filtration/ Disinfection)	MF^2	RO^2	AOP^2	RRT	Total
Virus	12	2	0 - 5^3	0	2	6	2 - 4^4	12-19
Giardia	10	2	--	4	2	6	0	14
Crypto-sporidium	10	1	--	4	2	6	0	13

Notes:

1 – Credits granted for the Los Angeles County Sanitation Districts Water Reclamation Plants that provide source water to the Vander Lans Advanced Treatment Facility based on information in the literature. The SBWR system would have to conduct a similar evaluation to be assigned these credits

2 - MF credits based on pathogen credits granted by DDW in drinking water applications and to Cambria Community Services District for the Cambria Emergency Water Supply project. RO credits based on pathogen credits granted by DDW in drinking water applications (Sand City Desalination Facility). UV/peroxide credits based on credits granted for Vander Lans and Cambria.

3 – Virus removal for tertiary treatment will have to be proven and negotiated with DDW.

4 – Based on Darcy Law equation calculation result of 4.5 months (see Section 3.2). Groundwater flow modeling may produce more technically-rigorous estimates.

5.2 California Environmental Quality Act

The California Environmental Quality Act (CEQA) was enacted in 1970 for the purpose of providing decision-makers and the public with information regarding environmental effects of proposed projects; identifying means of avoiding environmental damage; and disclosing to the public the reasons behind a project's approval even if it leads to environmental damage. CEQA applies only to discretionary government activities, referred to as "projects." Under CEQA, a project is defined as the whole of an reasonable foreseeable indirect physical change in the environment. Once a determination has been made that a project exists, there are three basic levels of environmental documentation:

- Exemption;
- Negative Declaration (includes those with or without mitigation); and,
- Environmental Impact Report (EIR)

The first step of the CEQA process would be to see if the proposed activities are specifically identified as being exempt from CEQA under Article 18 of the CEQA Guidelines (i.e., Statutory Exemptions) and categories of activities that are recognized under CEQA as generally having no significant effect on the environment pursuant to Article 19 of the CEQA Guidelines (i.e., Categorical Exemptions). If it can be concluded that the proposed project falls under the class of exempt projects, then an exemption from

However, if the Lead Agency under CEQA (the Lead Agency is the public agency which has the principal responsibility for carrying out or approving the project) determines that an exemption does not apply, then an Initial Study (IS) would need to be prepared to analyze whether the implementation of the proposed project (i.e., construction and operation) would have the potential to result in a significant impact upon the environment. Should the IS analysis conclude that all impacts associated with the proposed project are less than significant or can be mitigated to a level that is less than significant,

5.3 Building Permit

A building permit would need to be obtained prior to the construction phase of the satellite AWPF. Before applying for a building permit, preliminary site plans would need to be submitted to the City of Santa Clara Planning Division for initial architectural review and approval. The site plans must include property lines, building and setback lines, landscaping, signs, fencing, design of ingress and egress, off-street parking, loading facilities, trash disposal, and exterior elevations. Any necessary Planning Commission or special staff committee approvals must be applied for at this time. The project would not involve a land use zoning change since the Well 16-02 parcel and neighboring property are zoned heavy

After architectural approval is obtained, final construction drawings (stamped and signed) would be submitted for plan check review at the City of Santa Clara Building Inspection Office (BIO). At the time of submittal, plans are screened for completeness and the appropriate plan check fees would be required

Depending on complexity of the project, the City could approve the permit over the counter or route the plans for additional review. The processing of the application could take two to four weeks after the receipt of final plans. An approximate timeline of three months should be allotted for the review and approval of the building permit to account for initial review time, receipt of comments, incorporation of comments, and subsequent comment address and review cycles to ensure the completeness of addressing all plan check comments. The Building Inspection plan check review may be expedited by using an approved third party plan check agency. Any applicable agency approvals must be obtained

5.4 Industrial Discharge Permit

The discharge of waste streams into the sanitary sewer system would require a permit from San José authorizing industrial process water discharges to the sanitary sewer and SJ/SC RWF. A discharge application and associated fee must be submitted to and approved by San José. Monitored industrial sewer service and use charge unit rates for Fiscal Year 2014-15 are shown in Table 5-2. The charges are fundamentally based on the flow rate being discharged to the sewer as well as the quantity in pounds per day (ppd) of biological oxygen demand (BOD), total suspended solids (TSS), and ammonia (NH_3)

Table 5-2: Preliminary Industrial Discharge Fee Estimate

	Amount	Unit Cost[1]	Annual Cost
Capital Cost Recovery			
Annual charge per mgd of flow capacity	0.24 mgd	$310,387	$74,089
Annual charge per thousand ppd of BOD removal capacity	29 ppd[2]	$22,742	$659
Annual charge per thousand ppd of TSS removal capacity	14 ppd[2]	$15,288	$221
Annual charge per thousand ppd of NH_3 removal capacity	12 ppd[2]	$60,834	$734
Annual Subtotal			$75,700
O&M Cost Recovery			
Daily charge per mgd of flow capacity	0.24 mgd	$2,830	$676
Daily charge per ppd of BOD removal capacity	29 ppd[2]	$0.164	$5
Daily charge per ppd of TSS removal capacity	14 ppd[2]	$0.184	$3
Daily charge per ppd of NH_3 removal capacity	12 ppd[2]	$1.394	$17
Annual Subtotal			$255,400
Total Annual Charge			**$330,100**

Notes:
1 – Sanitary Sewer Service and Use Charges: http://www.sanjoseca.gov/index.aspx?NID=1649
2 – Water quality assumptions based on 2012 yearly average tertiary water quality for the SJ/SC RWF and 60/40 blend of RWF effluent and SVAWPC product water in the SBWR source water for the satellite AWPF.

The estimated annual charge is approximately $330,100. This approximate fee is included in the cost estimate presented in Section 6 and would need to be coordinated and confirmed with both San José and Santa Clara during the implementation of the near-term project

6. Conceptual Cost Estimate

This section includes the conceptual estimates of the probable construction cost for the near-term injection well project in Santa Clara. The conceptual cost estimates include capital and O&M cost estimates

The conceptual capital cost estimates for the project were developed based on other similar IPR projects, previous District estimates, equipment cost quotations from vendors, industry publications, and typical pipeline installation costs. Depending on the stage of the project and the level of detail understood, different estimating accuracies can be assumed. Since the Strategic Plan project is a preliminary planning phase project, these estimates are considered Class 5 estimates based on the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries (2005). Class 5 estimates are based on a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The

- 20 percent contingency to account for unknown or unforeseen construction costs.
- 30 percent implementation factor to account for the costs for program management, planning and environmental documentation, permits, engineering, design and construction services, construction management and inspections, and typical overhead items such and legal and
- administration services.

O&M costs are the recurring annual expense to operate and maintain the satellite AWPF after construction is completed. The O&M cost elements include items such as power, labor, chemicals, replacement of consumables (membranes, cartridge filters) and maintenance. The O&M cost estimates for the potable reuse alternatives are developed based on previous District estimates and other similar

Table 6-1 presents the capital and O&M cost estimates for the near-term project. See Appendix C for a cost estimate breakdown. Option 1 assumes that the existing production well can be repurposed for direct injection. Option 2 assumes that the existing well cannot be repurposed and a new injection well has be to be drilled on the site. While the satellite AWPF production capacity would be 1.0 mgd (1,120 AFY), an online factor of 90 percent is applied to the facility to consider AWPF downtime for cleaning/maintenance or reduced delivery from the SBWR system. This would result in an annual yield

Table 6-1: Near-term Project Conceptual Cost Estimate1

	Option 1 **(Reuse Existing Well)**	**Option 2** **(New Injection Well)**
Yield (AFY)	1,000	1,000
Capital Cost ($M)	$8.4	$10.7
Annual O&M Cost ($M) [2]	$1.1	$1.2
Annualized Capital Costs ($M) [3]	$1.0	$1.3
Total Annualized Cost ($M)	$2.1	$2.4

Notes:

1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.

2 – Does not include SBWR recycled water purchase rate. Annual O&M cost will increase when this item is incorporated into the estimate.

3 – Capital costs are annualized over 10 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%. Capital costs do not include land/property acquisition from the neighboring parcel and San José sanitary sewer/treatment plant connection fees. The capital cost will increase after this item is incorporated into the estimate.

4 – Cost per AF will increase once the O&M cost elements identified in Note 3 are included in the estimate.

7. Implementation Schedule and Next Steps

The primary next step for the near-term project would be to initiate additional studies in 2015, e.g. groundwater modeling, inspection/testing of Well 16-02, and detailed evaluation of the SBWR and sanitary sewer connections. The regulatory and permitting approach would need to be developed. The additional land required for the satellite AWPF would need to be procured or leased. The preliminary

Concurrent with the initial studies, the public outreach and funding/financing plan would need to be developed to allow the project to proceed on schedule. In addition, early in the project, San José and SCVWD would need to finalize agreements for SBWR agreement for recycled water and the San José

Following the completion of the initial studies and preliminary design, the project would move into detailed design concurrent with environmental documentation and permitting. Once the environmental documentation is complete and the permits finalized, then construction would commence.

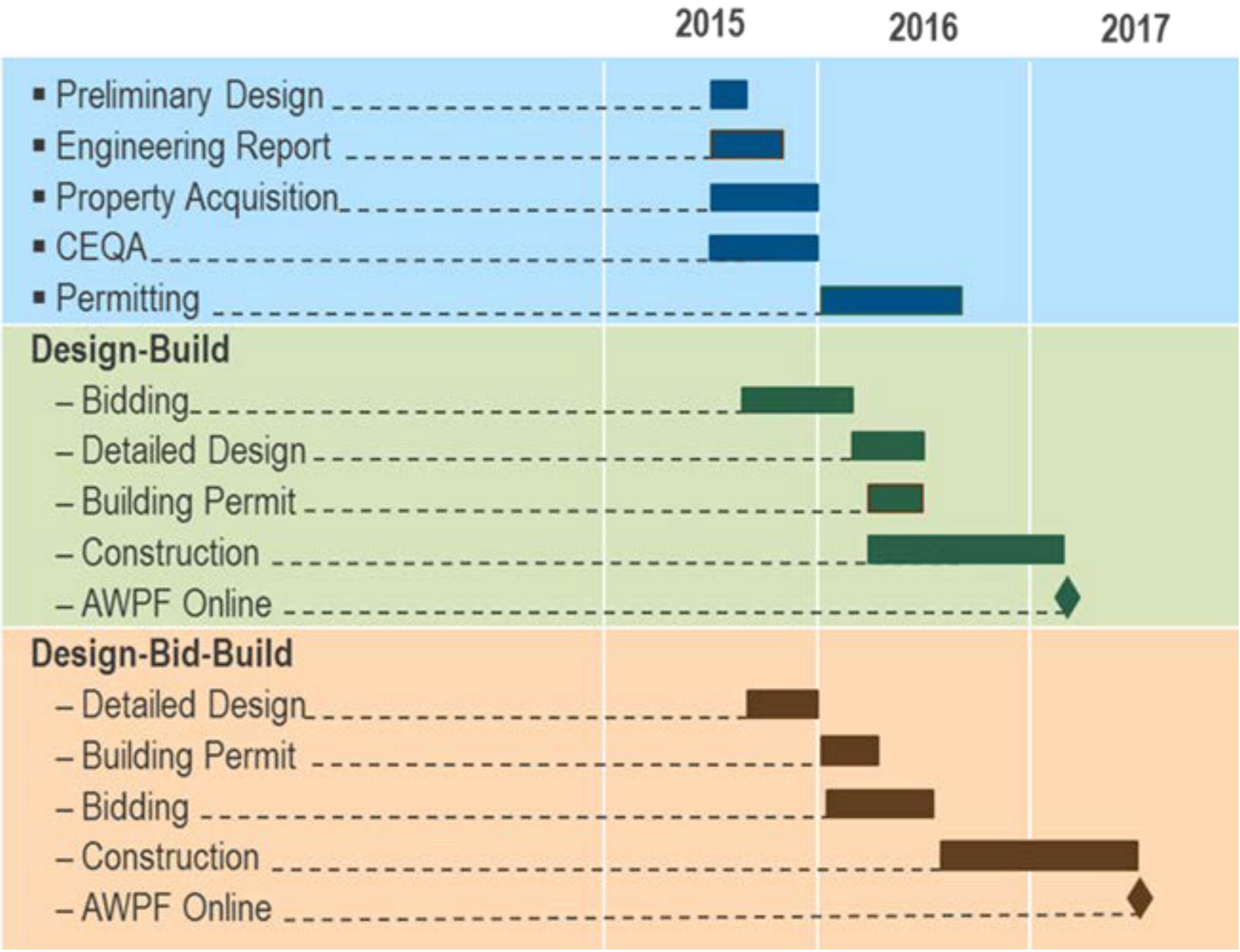
Table 7-1 summarizes the implementation plan elements organized by seven main categories of activities.

Table 7-1: Near-term Implementation Plan Elements

Categories	Elements
Additional Studies	- Groundwater modeling - Existing well inspection - Conveyance pipeline alignment and connection capacity analyses (SBWR connector, waste discharge)
Environmental Documentation	- CEQA
Permitting	- Potable reuse permit - Building permit - Industrial discharge permit - Easement/ROW permits
Institutional	- Additional land procurement next to existing well site - SBWR agreement for recycled water - Santa Clara agreement for groundwater injection - San José industrial discharge permit
Preliminary Design and Detailed Design	- Satellite AWPF - Pipelines Injection well
Public Outreach	- Public outreach plan and implementation
Funding/Financing	- Funding/financing plan and implementation

The preliminary implementation schedule is shown in Figure 7-1. Assuming that the preliminary design starts in mid-2015, the project would be complete by mid-2017.

Figure 7-1: Preliminary Implementation Schedule



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Attachments

Appendix A: Well 16-02 Geologic Log

Appendix B : Example Process Facility Drawings

Appendix C : Conceptual Cost Estimates

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Appendix A
Well 16-02 Geologic Logs

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1969

Well #16-02

LOG OF WELL FOR CITY OF SANTA CLARA
SANTA CLARA, CALIFORNIA

Drillers:

J. Montesino
C. Clampet
W. I. Durant

Jan.	20	0 to	3	3 Ft.	Top Soil
	20	3	33	30	Yellow Sandy Clay
	30	33	48	15	" " "
	30	48	60	12	Fine Sand
	30	60	80	20	Gravel
	31	80	92	12	"
	31	92	110	18	Blue Clay
	31	110	146	36	Gravel (Blue Clay Streaks)
	31	146	166	20	Blue Sandy Clay & Gravel
	31	166	191	25	Gravel (Clay Streaks)
	31	191	214	23	Gravel (Tight)
Feb.	3	214	238	24	Gravel
	3	238	250	12	Yellow Clay & Gravel
	3	250	289	39	Gravel
	3	289	300	11	Blue Sandy Clay
	3	300	310	10	Gravel
	3	310	340	30	Yellow Sandy Clay & Gravel
	3	340	354	14	Gravel, few Boulders
	3	354	364	10	Sand packed in Yellow Clay
	3	364	372	8	Hard Yellow Sandy Clay & Gravel
	3	372	387	15	Cemented Gravel
	3	387	395	8	Blue Sandy Clay
	4	395	406	11	Blue Clay
	4	406	426	20	Blue Clay & Gravel
	4	426	446	20	Gravel
	4	446	490	44	Blue Clay & Gravel
	4	490	575	85	Yellow Clay & Gravel
	4	575	610	35	Blue Sandy Clay
	4	610	625	15	Yellow Clay
	4	625	643	18	Yellow Sandy Clay
	4	643	665	22	Yellow Sandy Clay & Gravel
	5	665	697	32	" " " " "
	5	697	713	16	Heavy Gravel
	5	713	741	28	Blue Clay & Gravel
	5	741	777	36	Yellow Clay & Gravel
	5	777	799	22	Yellow Sandy Clay & Gravel
	5	799	822	23	Yellow Sandy Clay (Hard)
	5	822	845	23	Yellow Sandy Clay, few Boulders
	6	845	870	25	" " " " "
	6	870	912	42	Blue Clay with Gravel

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Appendix B
Example Process Facility Drawings

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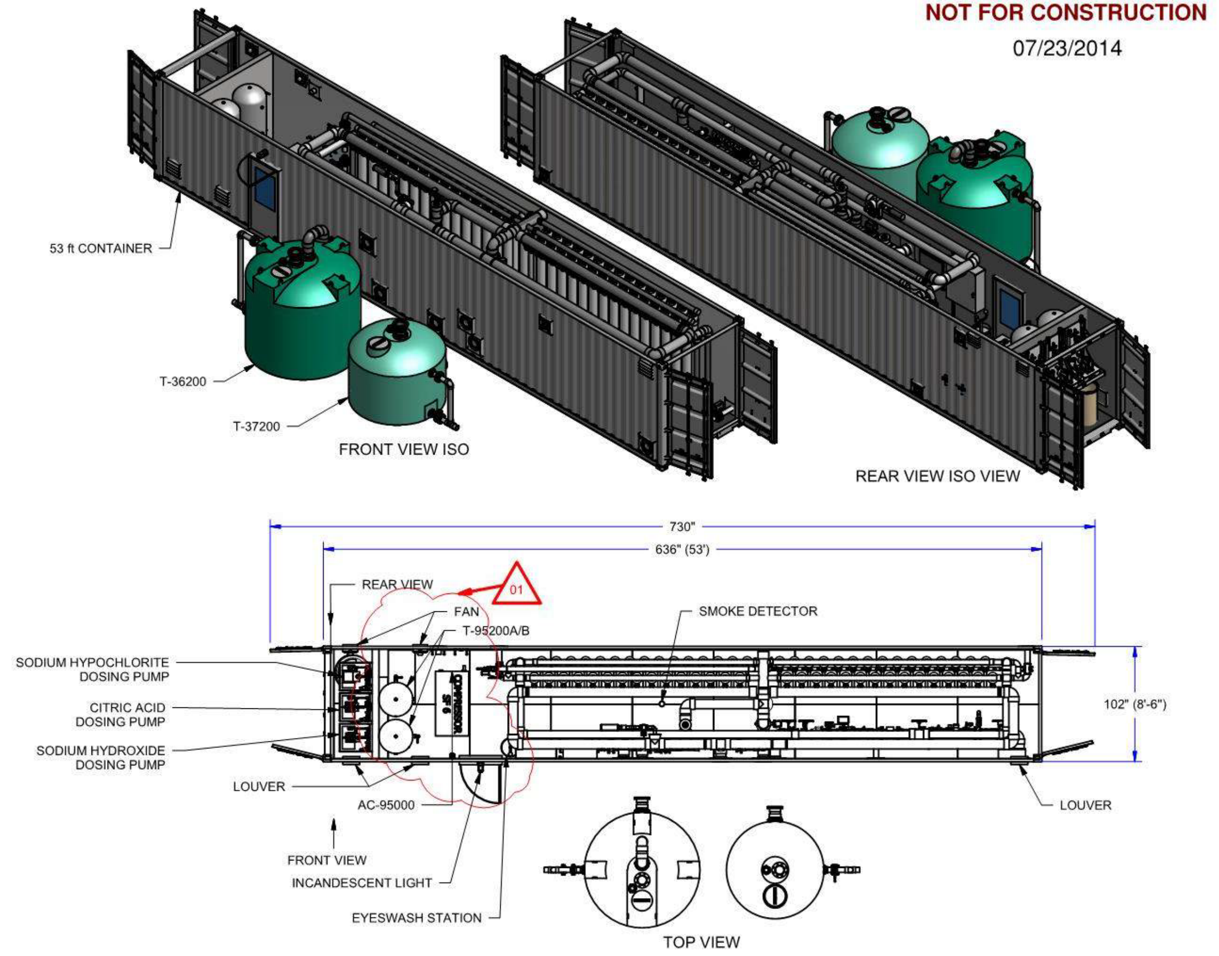
PRELIMINARY
NOT FOR CONSTRUCTION

07/23/2014



NOTES:

1. REFERENCE P&ID #P14761-C01-0001.
2. ALL WELDING TO CONFORM TO: AWS D1.1.
3. NO VERTICAL DOWN WELDS ARE ALLOWED UNLESS CERTIFIED PER AWS D1.1.
4. STITCH WELDS NOT ALLOWED UNLESS APPROVED BY H_2O INNOVATION.
5. WELDER CERTIFICATION FOR ALL WELDERS MUST BE PROVIDED TO H_2O INNOVATION.
6. BOLTS AND NUTS ARE STAINLESS STEEL TYPE 18-8 SS.
   WASHERS AND LOCK WASHERS ARE STAINLESS STEEL TYPE 18-8 SS.
   DIMENSIONS PER ASME B18.2.1.
   MECHANICAL PROPERTIES PER CONDITION CW OF ASTM F593.
   THREADS PER ANSI B1.1 CLASS 2A.
7. ALL STAINLESS STEEL TO BE PASSIVATED TO ASTM 380-06.
   TEST REPORT REQUIRED.
8. SAND BLAST TO SSPC-SSP6 FINISH, ACCEPTABLE FOR POWDER COAT OR PAINTING.
9. APPLY ONE (1) COAT, WITH MINIMUM DRY FILM THICKNESS (DFT) PER COAT OF 4 TO 7 MILS, OF POLYAMIDE EPOXY PRIMER, PITT-GUARD 95-245 SERIES FROM PPF OR APPROVED EQUAL.
10. APPLY TWO (2) COATS, WITH MINIMUM DRY FILM THICKNESS (DFT) PER COAT OF 2 TO 3 MILS, OF ACRYLIC ALIPHATIC URETHANE PAINT. PITTHANE ULTRA 95-812 SERIES FROM PPG OR APPROVED EQUAL. TO ACHIEVE FINAL 8 TO 13 MILS TOTAL DRY FILM THICKNESS.
11. ALL PVC PIPE TO BE SCHEDULE 80, GRAY, U.N.O.
    PIPE MATERIAL TO CONFORM TO ASTM D-1784.
    PHYSICAL DIMENSIONS, SCHEDULES, AND TOLERANCES TO CONFORM TO ASTM D-1785.
12. ALL PVC FITTINGS TO BE SCHEDULE 80, GRAY. SOCKET FITTINGS TO CONFORM TO ASTM D-2467.
13. ALL PVC FLANGED CONNECTIONS TO BE VAN STONE STYLE WITH GLASS FILLED PVC RING, CLASS 150, U.N.O. PVC MATERIAL TO CONFORM TO ASTM D-1784. BOLT HOLE PATTERN PER ANSI B16.5; ASTM D-4024.
14. PRIMER TO CONFORM TO ASTM-656.
    PVC SOLVENT CEMENT TO CONFORM TO ASTM D-2564.
15. ALL GASKETS TO CONFORM TO ASTM F-447.
16. TAP (½" NPT ONLY) INTO PVC / CPVC FITTING IS ALLOWED BUT ONLY IN SPECIFIC LOCATION WHERE NO ADEQUATE FITTING IS PROVIDED.
17. FINISHED ASSEMBLY (WITHOUT HFUF MODULES) MUST BE HYDROSTATICALLY TESTED TO 70 psi. TESTING MUST BE WITNESSED BY AN H2O INNOVATION REPRESENTATIVE.
18. FITTINGS PROTRUDING THROUGH THE ROOF WILL BE REMOVED FOR SHIPPING TO BE SITE INSTALLED.
19. APPROXIMATE WEIGHT: 82,061 LBS.

TOTAL QUANTITY REQUIRED FOR THE PROJECT:	1

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REV	DATE	REVISION DESCRIPTION	DRAWN	CHKD	ENG	APPVD
01	2014-02-21	REVISED PER COMMENTS	Y.D.	B.K.	R.G.	R.G.
00	2014-02-03	PRELIMINARY	Y.D.	B.K.	R.G.	R.G.

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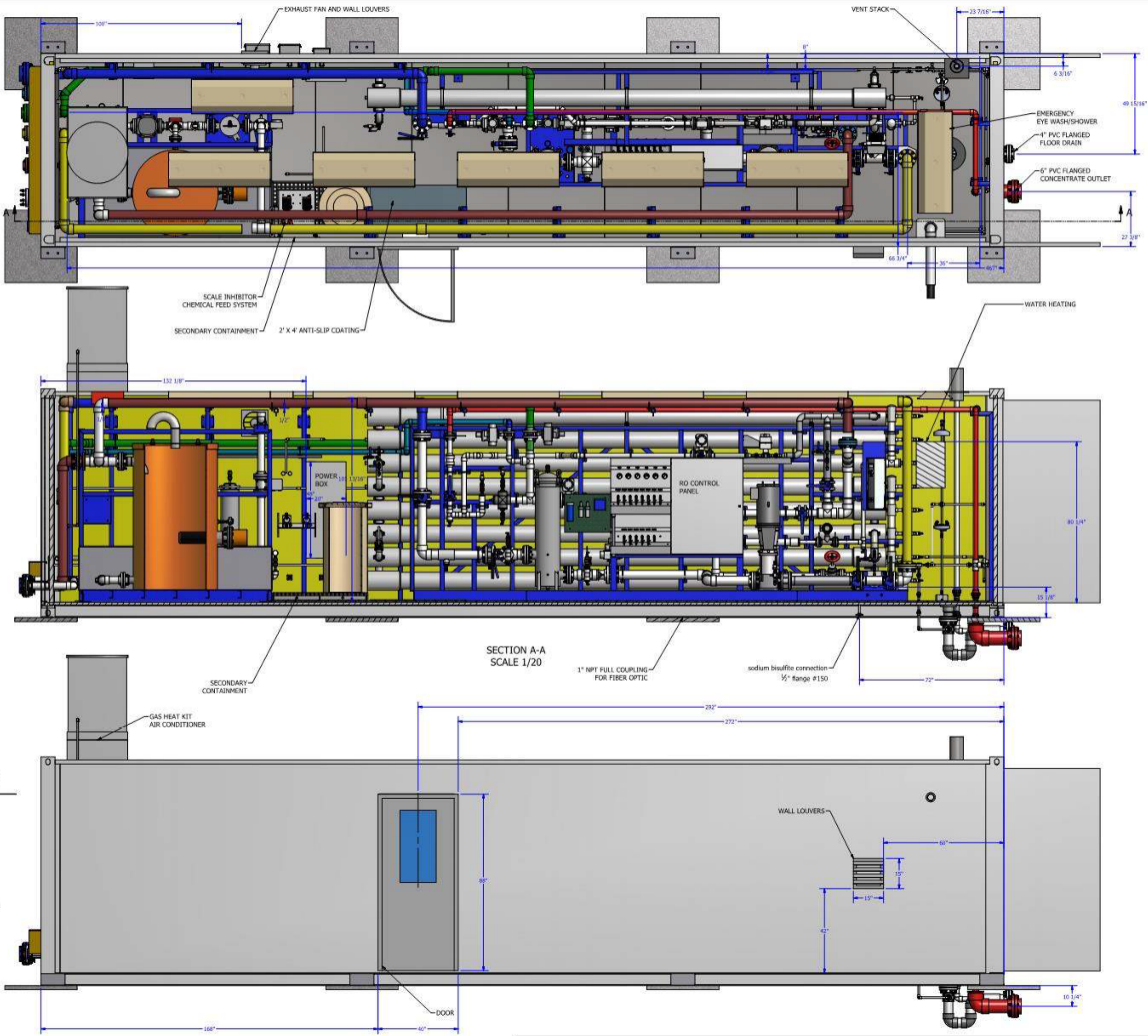
UF GENERAL ARRANGEMENT

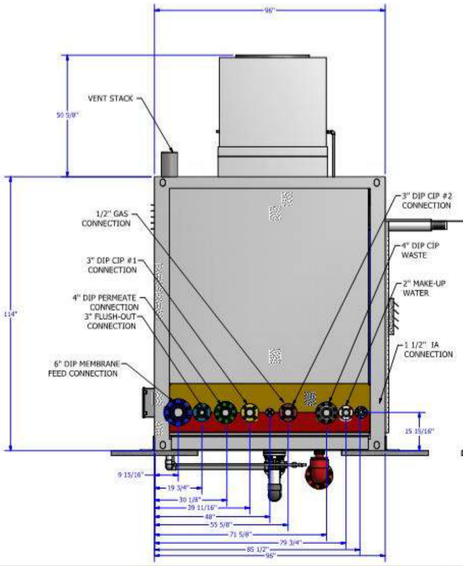
TOP VIEW
NANOFILTER BLDG NO.1
PRELIMINARY DRAWING

PRELIMINARY
NOT FOR CONSTRUCTION

APPROXIMATE WEIGHTS
SHIPPING WEIGHT = 24 600 LBS

07/23/2014





PRIMARY RO TRAIN #1 GENERAL ARRANGEMENT

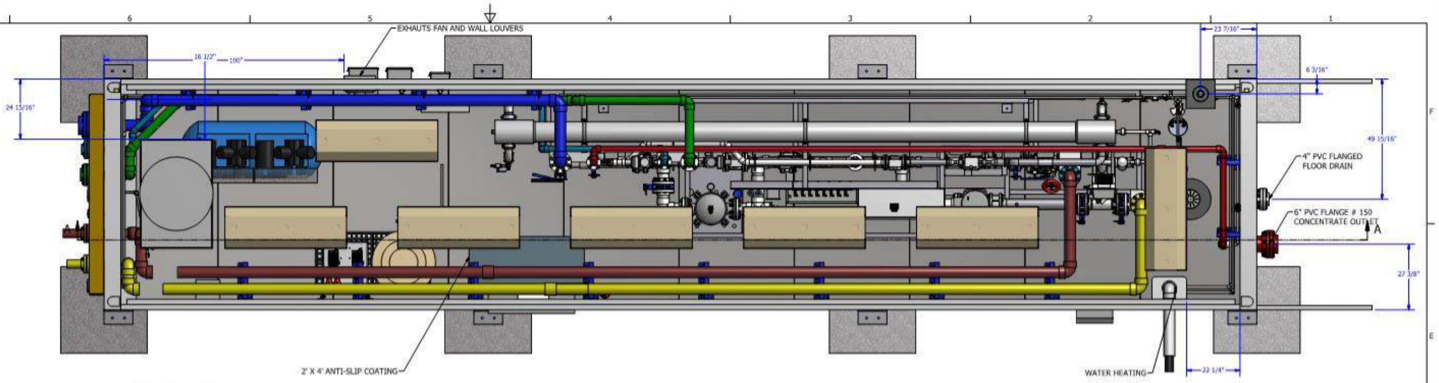
TOP VIEW
NANOFILTER BLDG NO.02
PRELIMINARY DRAWNG

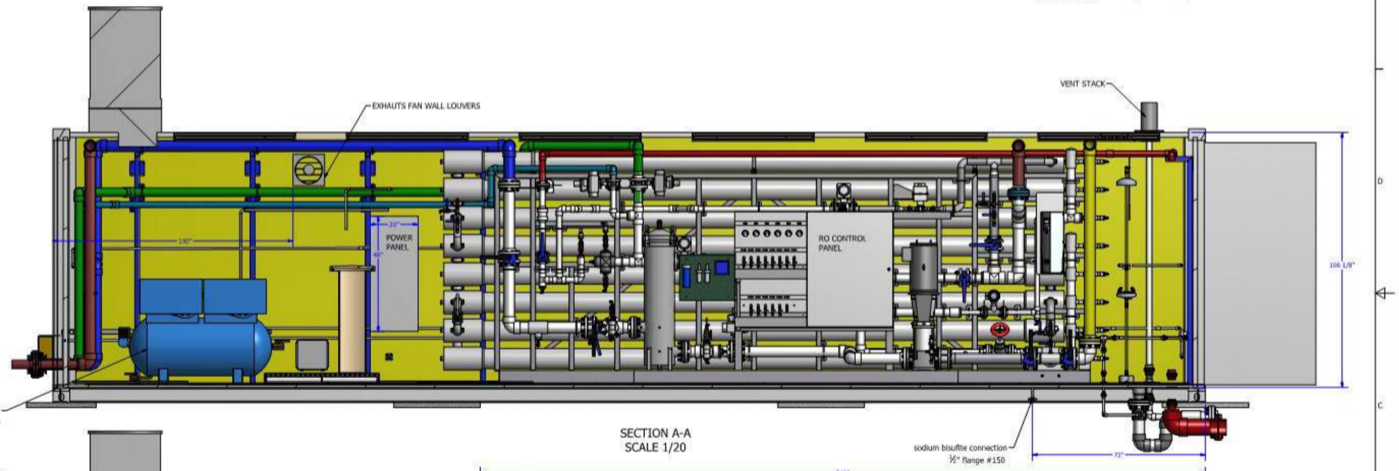
APPROXIMATE WEIGHTS
SHIPPING WEIGHT 21 385 LBS

PRELIMINARY
NOT FOR CONSTRUCTION

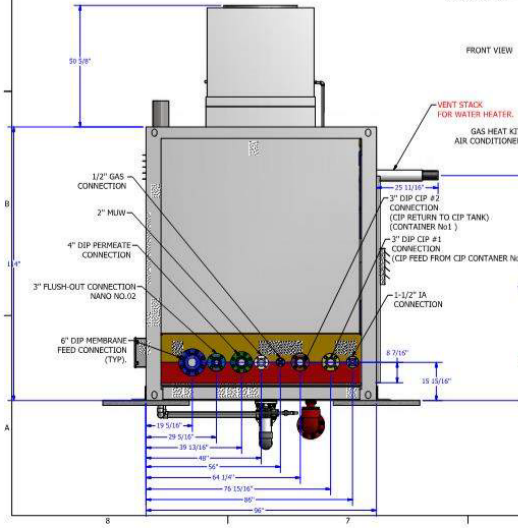
07/23/2014

TOP VIEW

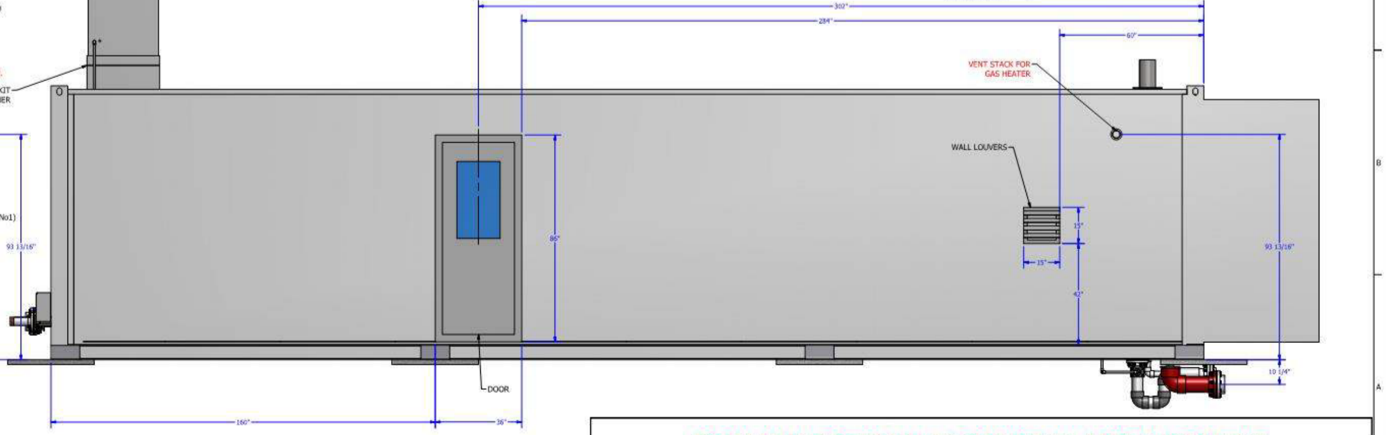

EXHAUTS FAN AND WALL LOUVERS
16 1/2"
100"
24 15/16"
23 7/16"
6 3/16"
49 15/16"
4" PVC FLANGED FLOOR DRAIN
6" PVC FLANGE # 150 CONCENTRATE OUTLET
A
27 3/8"
2' X 4' ANTI-SLIP COATING
WATER HEATING
22 1/4"



SECTION A-A
SCALE 1/20


50 5/8"
114"
1/2" GAS CONNECTION
2" MUW
4" DIP PERMEATE CONNECTION
3" FLUSH-OUT CONNECTION NANO NO.02
6" DIP MEMBRANE FEED CONNECTION (TYP).
VENT STACK FOR WATER HEATER.
25 11/16"
3" DIP CIP #2 CONNECTION (CIP RETURN TO CIP TANK) (CONTAINER No1)
3" DIP CIP #1 CONNECTION (CIP FEED FROM CIP CONTANER No1)
1-1/2" IA CONNECTION
8 7/16"
15 15/16"
93 13/16"
19 5/16"
29 5/16"
39 13/16"
48"
56"
64 1/4"
76 15/16"
86"
96"

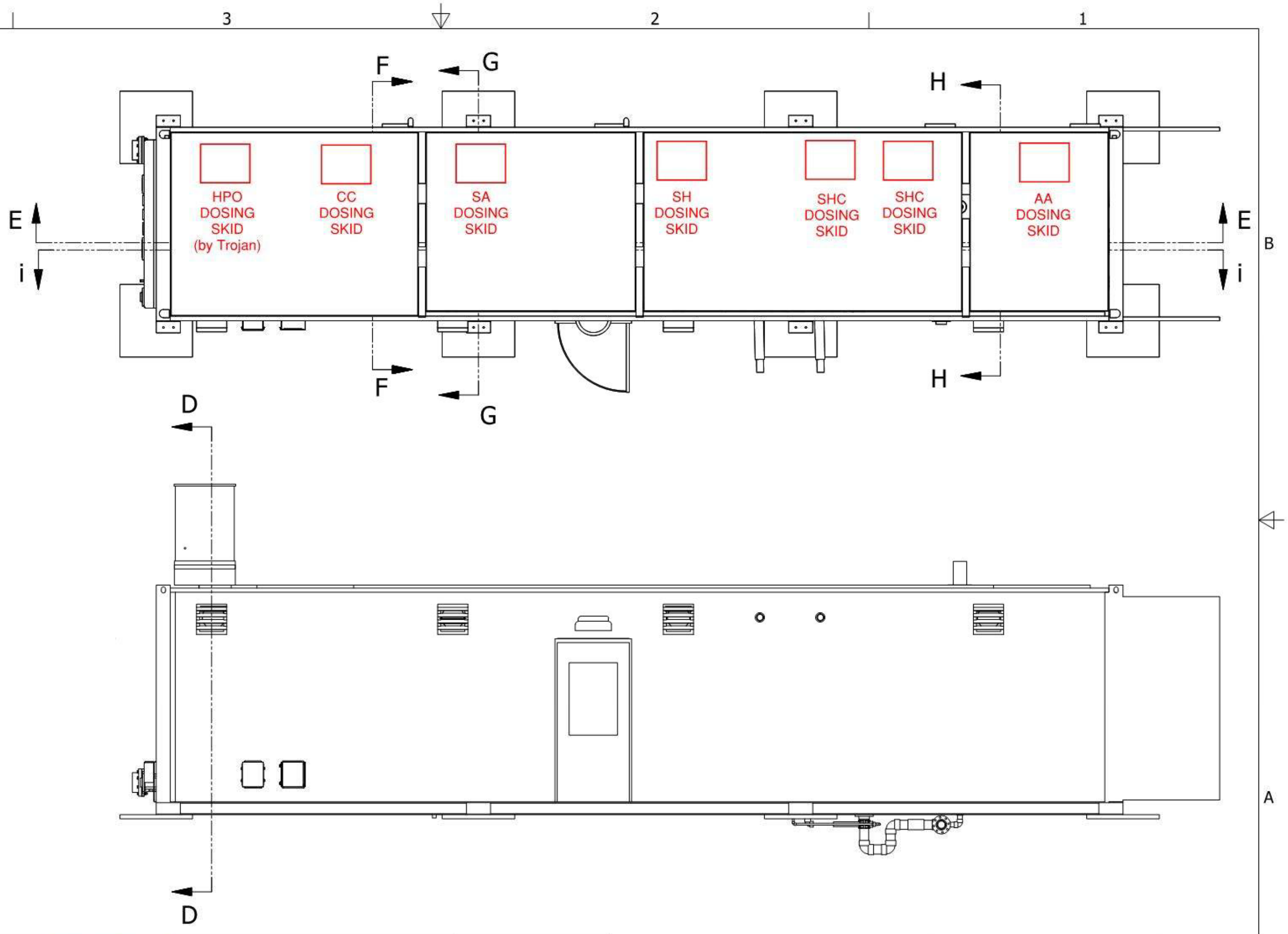
FRONT VIEW



PRIMARY RO TRAIN #2 GENERAL ARRANGEMENT

PRELIMINARY
NOT FOR CONSTRUCTION

07/23/2014



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DRAWING REVISION

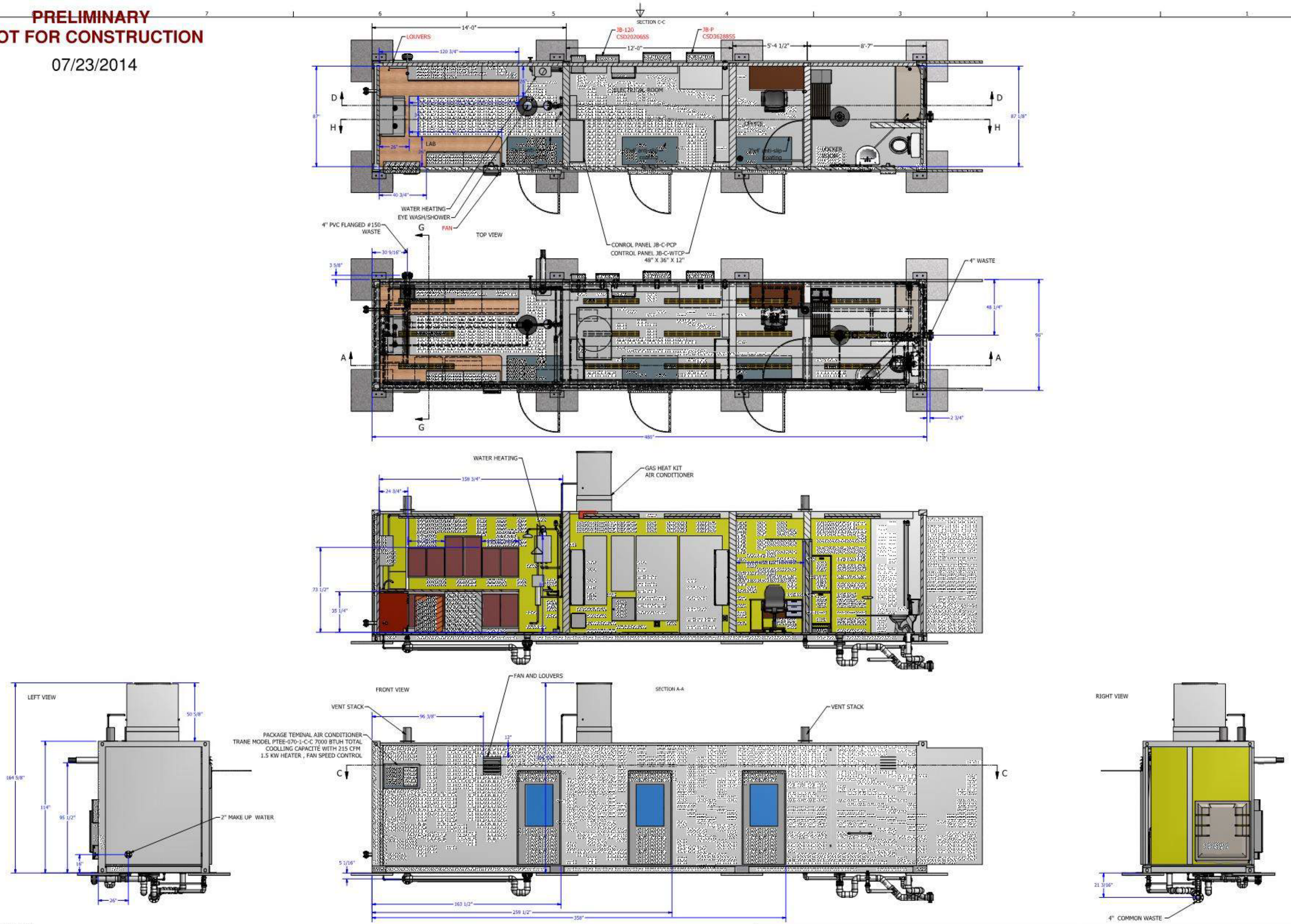
REV.	DATE	REVISION DESCRIPTION	DRAWN	CHKD.	ENG.	APPVD.

h2o innovation

CHEMICAL CONTAINER GENERAL ARRANGEMENT

PRELIMINARY
NOT FOR CONSTRUCTION

07/23/2014



APPROXIMATE WEIGHT
SHIPPING WEIGHT = 14 250 LBS

CONTROL BUILDING GENERAL ARRANGEMENT

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Appendix C
Conceptual Cost Estimate

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Project: SBWR Strategic and Master Plan

Component: Near-Term Mid-Basin IPR

Date:	November 10, 2014
Project Number:	0057-007.02
Prepared by:	AG

AWPF Production Capacity 1.0 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 173,000	
3 - Concrete	$ 60,000	
5 - Metals	$ 20,000	
11 - Equipment	$ 3,572,000	
15 - Mechanical	$ -	
16 - Electrical	$ 714,400	
17- I&C	$ 357,200	

	RAW CONSTRUCTION COST		**$ 4,896,600**
Construction Contingency		20%	$ 979,000
	BASE CONSTRUCTION COST		**$ 5,875,600**
Implementation (Program Management, Design, CEQA, Legal, CM)		30%	$ 1,763,000
Easements			$ -
Project Contingency		10%	$ 763,860
	TOTAL PROJECT COST		**$ 8,402,460**

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 173,000**	
	Clearing and demolition			1	LS	$ 25,000.00	$ 25,000	AC pavement, structural demo and clearing
	Earthwork			1	LS	$ 8,333.33	$ 8,000	Assume use site soil, no import
	Pavement			1	LS	$ 17,500.00	$ 18,000	Coleman driveway and misc patchwork
	Yard piping			1	LS	$ 15,000.00	$ 15,000	Minimal 300 lf subsurface
	Site fencing and gates			1	LS	$ 21,200.00	$ 21,000	400 lf chain-link fence and 3 gates
	Fire water loop			1	LS	$ 23,200.00	$ 23,000	400 loop and 2 fire hydrants
	Bollards			1	LS	$ 10,000.00	$ 10,000	20 posts
	SBWR connection			1	LS	$ 25,000.00	$ 25,000	Connection pipeline to Coleman Ave
	Sewer connection			1	LS	$ 15,000.00	$ 15,000	Connection pipeline to Coleman Ave
	Potable water connection			500	lf	$ 25.00	$ 13,000	
							$ -	
3 - Concrete							**$ 60,000**	
	Concrete pad and slab areas			1	LS	$ 60,000	$ 60,000	Slab on grade pads
							$ -	
5 - Metals							**$ 20,000**	
	Misc metals allowance			1	LS	$ 20,000	$ 20,000	
							$ -	
11 - Equipment							**$ 3,572,000**	
	AWPF equipment incl. MF container, RO trailer, Control Room trailer, chemical dosing trailer, chemical storage tanks, break tank, product water tank, feed pumps, product water pump station	1.0	mgd	1	LS	$ 3,100,000.00	$ 3,209,000	Includes interconnecting pipes, skid installation, etc.
	UV disinfection system	1.0	mgd	1	LS	$ 350,000.00	$ 363,000	Includes interconnecting pipes, skid installation, etc.

Project: SBWR Strategic and Master Plan

Component: Near-Term Mid-Basin IPR

Date: November 10, 2014
Project Number: 0057-007.02

Prepared by: AG

AWPF Production Capacity 1.0 mgd
Estimate Type: Conceptual Planning

15 - Mechanical			**$**	**-**
			$	-
16 - Electrical			**$**	**714,400**
Electrical Allowance	20% of Division 11 (Equipment)	20%	$	714,400
17 - I&C			**$**	**357,200**
I&C Allowance	10% of Division 11 (Equipment)	10%	$	357,200

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	
						$	**-**
						$	-

ANNUAL O&M COSTS

		Amount	Unit	Value		Cost	
Consumables				Total Consumables	**$**	**78,000**	
	Equipment Consumables	$ 3,572,000		2%	$	71,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$	-	2% of Mechanical
	Instrumentation Consumables	$ 357,200		2%	$	7,000	2% of Instrumentation
Power Costs				Total Power		**$180,000**	
	Satellite AWPF		Horsepower				
			Hours per year operation				
			Annual Cost			$180,000	Adapted from District's TM 8A
Chemicals				Total Chemicals	**$**	**86,000**	
	AWPF Chemicals					$86,000	Adapted from District's TM 8A + AOP from similar
					$	-	FAT project
					$	-	
Labor Costs				Total Labor	**$**	**468,000**	
	Total # Operators	3	number				
	Average Annual Hours per operator	2080	hrs/yr				40 hrs/week, 52 weeks/year
	Total Operators per year	6240	Total hrs	$ 75		$468,000	
Other Costs				Total Other	**$**	**331,000**	
	SBWR Water	5,600	AFY		$	-	TBD
	Industrial sewer discharge fee				$	331,000	Sanitary Sewer Service and Use Charges 2014-15
			TOTAL ANNUAL O&M COSTS		**$**	**1,143,000**	

Project: SBWR Strategic and Master Plan

Component: Near-Term Mid-Basin IPR with New Injection Well

Date:	November 10, 2014
Project Number:	0057-007.02
Prepared by:	AG

AWPF Production Capacity 1.0 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 173,000	
3 - Concrete	$ 60,000	
5 - Metals	$ 20,000	
11 - Equipment	$ 3,572,000	
15 - Mechanical	$ 1,350,000	
16 - Electrical	$ 714,400	
17- I&C	$ 357,200	

	RAW CONSTRUCTION COST	**$**	**6,246,600**
Construction Contingency	20%	$	1,249,000
	BASE CONSTRUCTION COST	**$**	**7,495,600**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$	2,249,000
Easements		$	-
Project Contingency	10%	$	974,460
	TOTAL PROJECT COST	**$**	**10,719,060**

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 173,000**	
	Clearing and demolition			1	LS	$ 25,000.00	$ 25,000	AC pavement, structural demo and clearing
	Earthwork			1	LS	$ 8,333.33	$ 8,000	Assume use site soil, no import
	Pavement			1	LS	$ 17,500.00	$ 18,000	Coleman driveway and misc patchwork
	Yard piping			1	LS	$ 15,000.00	$ 15,000	Minimal 300 lf subsurface
	Site fencing and gates			1	LS	$ 21,200.00	$ 21,000	400 lf chain-link fence and 3 gates
	Fire water loop			1	LS	$ 23,200.00	$ 23,000	400 loop and 2 fire hydrants
	Bollards			1	LS	$ 10,000.00	$ 10,000	20 posts
	SBWR connection			1	LS	$ 25,000.00	$ 25,000	Connection pipeline to Coleman Ave
	Sewer connection			1	LS	$ 15,000.00	$ 15,000	Connection pipeline to Coleman Ave
	Potable water connection			500	lf	$ 25.00	$ 13,000	
							$ -	
3 - Concrete							**$ 60,000**	
	Concrete pad and slab areas			1	LS	$ 60,000	$ 60,000	Slab on grade pads
							$ -	
5 - Metals							**$ 20,000**	
	Misc metals allowance			1	LS	$ 20,000	$ 20,000	
							$ -	
11 - Equipment							**$ 3,572,000**	
	AWPF equipment incl. MF container, RO trailer, Control Room trailer, chemical dosing trailer, chemical storage tanks, break tank, product water tank, feed pumps, product water pump station	1.0	mgd	1	LS	$ 3,100,000.00	$ 3,209,000	Includes interconnecting pipes, skid installation,e tc.
	UV disinfection system	1.0	mgd	1	LS	$ 350,000.00	$ 363,000	Includes interconnecting pipes, skid installation,e tc.

Project: **SBWR Strategic and Master Plan**

Component: Near-Term Mid-Basin IPR with New Injection Well

Date:	November 10, 2014
Project Number:	0057-007.02
Prepared by:	AG

AWPF Production Capacity 1.0 mgd

Estimate Type: Conceptual Planning

15 - Mechanical							**$**	**1,350,000**	
	Injection well			1	ea	$ 1,350,000	$	1,350,000	Adapted from TM.8C costs w/o contingency
16 - Electrical							**$**	**714,400**	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$	714,400	
17 - I&C							**$**	**357,200**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$	357,200	
EASEMENT ACQUISITION							**Total Cost**		
	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$**	**-**	
							$	-	
ANNUAL O&M COSTS				**Amount**	**Unit**	**Value**		**Cost**	
Consumables						Total Consumables	**$**	**98,000**	
	Equipment Consumables			$ 3,209,000		2%	$	64,000	2% of Equipment
	Mechanical Consumables			$ 1,350,000		2%	$	27,000	2% of Mechanical
	Instrumentation Consumables			$ 357,200		2%	$	7,000	2% of Instrumentation
Power Costs						Total Power		**$180,000**	
	Satellite AWPF				Horsepower				
				Hours per year operation					
					Annual Cost			$180,000	Adapted from District's TM 8A
Chemicals						Total Chemicals	**$**	**86,000**	
	AWPF Chemicals							$86,000.00	Adapted from District's TM 8A + AOP from similar
							$	-	FAT project
							$	-	
Labor Costs						Total Labor	**$**	**468,000**	
	Total # Operators			3	number				
	Average Annual Hours per operator			2080	hrs/yr				40 hrs/week, 52 weeks/year
	Total Operators per year			6240	Total hrs	$ 75		$468,000	
Other Costs						Total Other	**$**	**331,000**	
	SBWR Water			5,600	AFY		$	-	TBD
	Industrial sewer discharge fee						$	331,000	Sanitary Sewer Service and Use Charges 2014-15
					TOTAL ANNUAL O&M COSTS		**$**	**1,163,000**	

Appendix 8C - Fast-Track Pipeline Indirect Potable Reuse Study Technical Memorandum

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South Bay Water Recycling
Strategic and Master Planning

Technical Memorandum

Title:	**Fast-Track Pipeline Indirect Potable Reuse Study**
Version:	**Administrative Draft**
Prepared by:	**Bruce Chalmers, CDM Smith** **Jennifer Thompson, CDM Smith** **Arthur Goh, CDM Smith** **Bob Allen, CDM Smith**
Reviewed by:	**Tom Richardson, RMC**
Date:	**December 10, 2014**
Reference:	**Task 3.1.1 Fast-Track Pipeline IPR Study**

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1. Introduction

1.1 TM Purpose

The purpose of this Fast-Track Pipeline Indirect Potable Reuse (IPR) Study is to further develop the concept of implementing a "quick implementation" project to assist in maintaining water levels in the main groundwater basin until a permanent IPR project can be brought on-line. This technical memorandum (TM) is developed as part of the Strategic and Master Plan, which was prepared by the City of San José (San José) in partnership with the Santa Clara Valley Water District (SCVWD or District), to evaluate how recycled water produced from the San José/Santa Clara Regional Wastewater Facility (SJ/SC RWF) could be used to meet the Strategic Plan recycled water goals. These goals are summarized in Table 1-1: Strategic Plan Recycled Water Targets

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: These targets are based on a baseline county-wide recycled water use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand).
Source: SBWR Strategic and Master Planning Report (RMC/CDM Smith, 2014).

to maximize the benefit of the Silicon Valley Advanced Water Purification Center (SVAWPC)

Table 1-1: Strategic Plan Recycled Water Targets

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: These targets are based on a baseline county-wide recycled water use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand).
Source: SBWR Strategic and Master Planning Report (RMC/CDM Smith, 2014).

This TM presents the concept for this fast track temporary IPR concept, including source analysis, alternative alignment review, a conceptual cost estimate, permitting, implementation schedule, and next steps.

1.2 TM Background

The Strategic and Master Planning program described a potential long-term potable reuse plan that included a potential 5-mgd mid basin injection IPR project in the City of Santa Clara. This mid basin potable reuse project would produce purified recycled water at a new, 5 mgd centralized AWPF located adjacent to the existing SVAWPC which provides TDS reduction for the South Bay Water Recycling's (SBWR) non-potable reuse (NPR) system. The SVAWPC is located in San José next to the San José/Santa Clara Regional Wastewater Facility (SJ/SC RWF).

The 5 mgd facility would be the second phase of a larger potable reuse system that would eventually treat up to about 30 mgd for potable reuse in the Los Gatos area. The water would be conveyed through a new pipeline to serve a combination of mid-basin injection and surface spreading at the Los Gatos recharge ponds, and potentially to direct potable reuse in the District's Central Pipeline. The recommended potable reuse program is presented in the SBWR Strategic and Master Planning Project Report (RMC/ CDM Smith, 2014).

The concept explored in this TM is a quick implementation, short-term IPR project that would include a temporary pipeline to transport up to 9 million gallon per day (mgd) of purified recycled water to recharge the groundwater basin through the Los Gatos ponds. This project would provide an emergency drought proof water supply, and would demonstrate the feasibility of IPR using the Los Gatos ponds for potable reuse in support the development of the long-term potable reuse program. This project would be developed as a temporary project since it would eventually be replaced by the larger, permanent potable reuse project at the Los Gatos ponds identified as part of the Strategic and Master Planning program.

1.3TM Organization

This TM is organized as follows:

1. Introduction
2. Project Concepts
3. Engineering Considerations
4. Permitting and Regulatory Considerations
5. Conceptual Alignment Evaluation
6. Alignment Evaluation
7. Fast-Track Pipeline Conceptual Project

2. Project Concepts

The concept for an IPR project in the Los Gatos pond area has been developed as part of the SBWR Strategic and Master Planning project. This part of the overall potable reuse project concept is to recharge the region's main groundwater basin with purified recycled water. The water would be percolated or injected into the groundwater aquifer and extracted from the basin through existing extraction wells and used for the potable water supply. Since the IPR project concept includes recharging the groundwater basin with injection wells in addition to percolation, advanced water purification treatment would include reverse osmosis (RO) and an advanced oxidation process (AOP), which is required by the Groundwater Reuse Regulations for groundwater replenishment with subsurface application.

At this time, it is envisioned that the District would pursue both short-term and long-term IPR project. The short-term projects would be temporary projects that would eventually be replaced by the long-term projects. The long term projects would consist of a satellite 5 mgd project in the Ford Pond area and a 29 mgd project that would convey purified recycled water from a centralized AWPF to the Los Gatos ponds area.

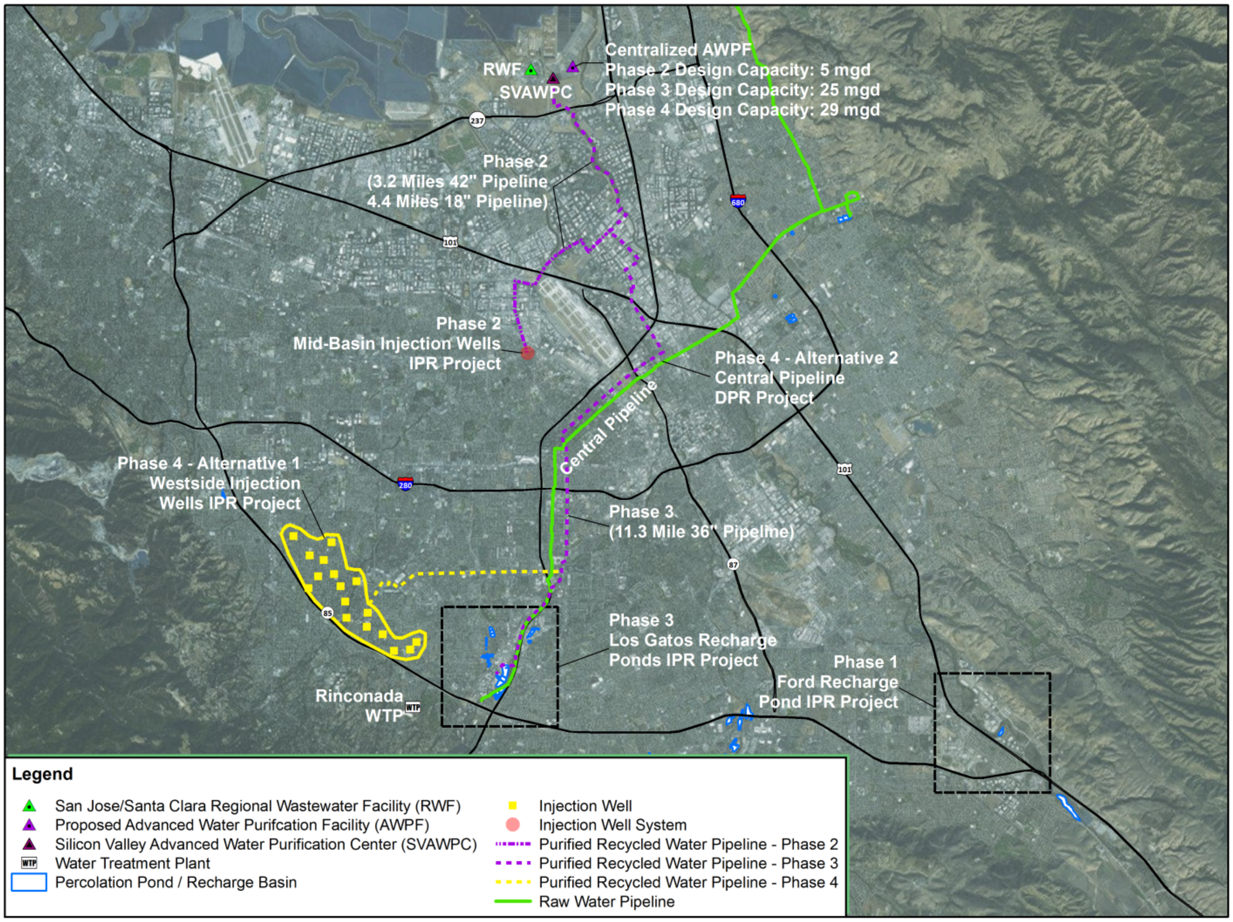
2.1 Long Term IPR Project Concept

A permanent long term IPR project is included as part of the recommended plan for potable reuse in the SBWR Strategic and Master Planning Report. The long-term potable reuse plan (see Figure 2) includes implementation of indirect potable reuse at the Los Gatos Recharge ponds. The Ford Pond project is Phase 1 of the IPR program and is a standalone facility located in the Ford Pond area of the Coyote Valley. The long term IPR program includes a strategy to build a pipeline to convey purified recycled water from a future centralized AWPF to the Los Gatos recharge ponds. This long-term IPR program would be implemented in the following phases. Note that Phase 1 is the satellite project in the Ford Pond area.

- **Phase 2** – 5 mgd of new centralized AWPF, 3.2 miles of 42 inch diameter and 4.4 miles of 18 inch diameter pipelines to the Santa Clara Mid Basin area, and approximately nine injection wells
- **Phase 3** – expansion of the AWPF to 25 mgd, an 11.3 mile, 36 inch diameter extension of the conveyance pipeline to the Los Gatos ponds, and modifications to the Los Gatos ponds to accept recycled water.
- **Phase 4** - expansion of the AWPF to 29 mgd and implementation of a connection from the recycled water pipeline to the District's raw water Central Pipeline for potable reuse or the construction of additional injection wells west of the Los Gatos ponds for continuing IPR.

Figure 2-1 shows the major facilities and the phasing for the District's potable reuse program as envisioned by the Strategic and Master Planning Program.

Figure 2-1: Long-Term Potable Reuse Project Concept


RWF
SVAWPC
Centralized AWPF
Phase 2 Design Capacity: 5 mgd
Phase 3 Design Capacity: 25 mgd
Phase 4 Design Capacity: 29 mgd
237
Phase 2
(3.2 Miles 42" Pipeline
4.4 Miles 18" Pipeline)
680
101
Phase 2
Mid-Basin Injection Wells
IPR Project
Phase 4 - Alternative 2
Central Pipeline
DPR Project
Central Pipeline
Phase 4 - Alternative 1
Westside Injection
Wells IPR Project
280
101
Phase 3
(11.3 Mile 36" Pipeline)
87
85
Phase 3
Los Gatos Recharge
Ponds IPR Project
Phase 1
Ford Recharge
Pond IPR Project
Rinconada
WTP
WTP
Legend
▲ San Jose/Santa Clara Regional Wastewater Facility (RWF)
▲ Proposed Advanced Water Purifcation Facility (AWPF)
▲ Silicon Valley Advanced Water Purification Center (SVAWPC)
WTP Water Treatment Plant
☐ Percolation Pond / Recharge Basin
■ Injection Well
● Injection Well System
Purified Recycled Water Pipeline - Phase 2
Purified Recycled Water Pipeline - Phase 3
Purified Recycled Water Pipeline - Phase 4
Raw Water Pipeline

2.2 Fast Track Project Coordination with the Long Term IPR Project

Because of the current drought and the pressure on the area's water supply, the District is considering ways to implement portions of the long term potable reuse program earlier than previously planned. One idea is to implement a potable reuse project early to provide drought relief by using the existing treatment capacity at the SVAWPC and constructing a fast track pipeline to convey the purified recycled water for groundwater recharge at the Los Gatos ponds. This project would maximize the use of existing SVAWPC treatment facilities as well as the existing percolation facilities at the Los Gatos Ponds. To connect these existing facilities in a short period of time, the District is considering construction of a temporary pipeline from the SVAWPC to the Los Gatos ponds. The temporary pipeline would be constructed above ground to avoid the cost and time required to construct an in-ground pipeline. This TM investigates the issues involved with repurposing the SVAWPC and constructing a temporary conveyance pipeline to the Los Gatos ponds, including alignments, costs and permitting challenges.

2.3 Similar Fast-Track Pipeline Project (Wichita Falls)

To provide information as to whether a temporary above ground pipeline is feasible, a search of similar projects in the United States was conducted. While not exactly the same because it was constructed in relatively undeveloped area as opposed to through the middle of a large metropolitan area, the Wichita Falls project in Texas was identified as a similar temporary fast-track recycled water pipeline project to serve potable reuse. The project constructed 63,000 linear feet of 27-inch diameter HDPE in 4 months. The construction cost was $13 million. The pipeline transports disinfected effluent from the River Road Wastewater Treatment Plant along the Holiday Creek Trail to the Cypress Water Treatment Plant where it is treated with microfiltration (MF) and reverse osmosis (RO) and blended 50/50 with lake water. Figure 2-2 shows the alignment of the Wichita Falls Fast-Track Pipeline. Figure 2-3 shows the HDPE string after it has been fused and strung out across a field. Figure 2-4 shows the HDPE pulled into place along the creek trail. The capacity required three 27-inch diameter pipes side by side.

Figure 2-2: Wichita Falls Fast-Track Pipeline Alignment

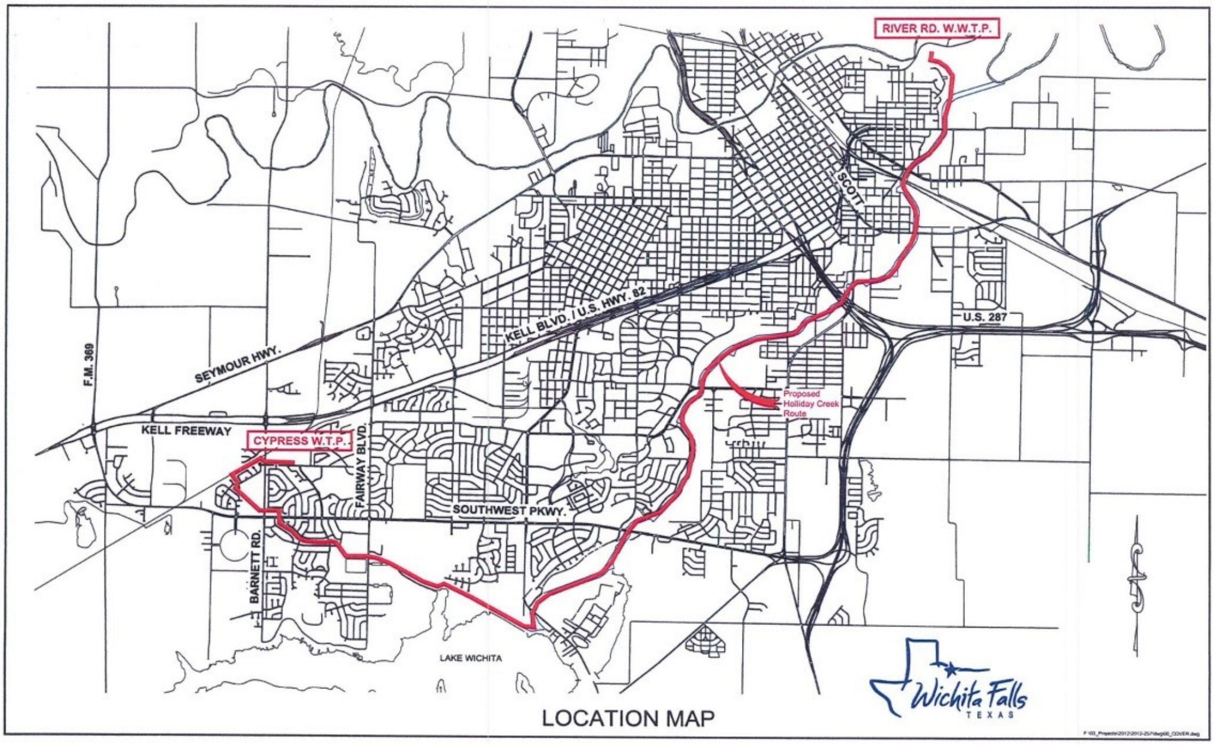


Figure 2-3: Fused String of 27-inch HDPE Ready to Pull into Place

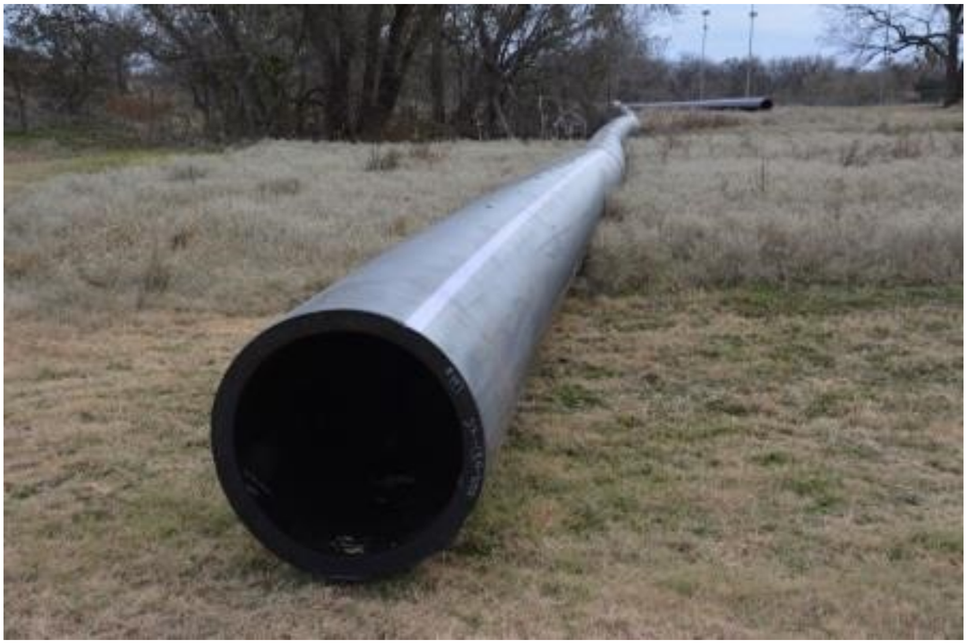
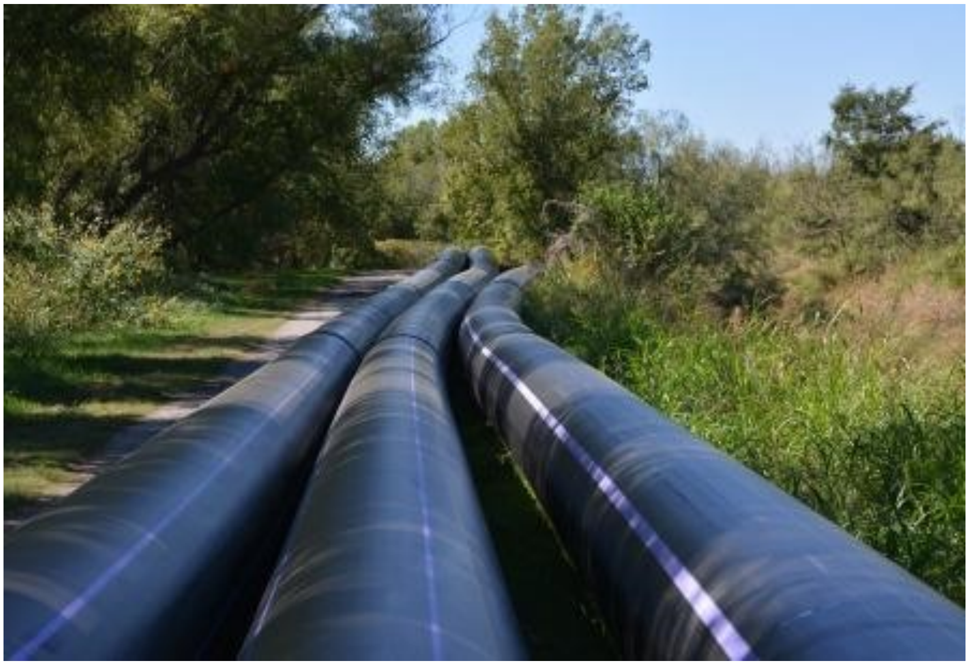


Figure 2-4: HDPE Pipe Pulled into Place along the Creek Trail



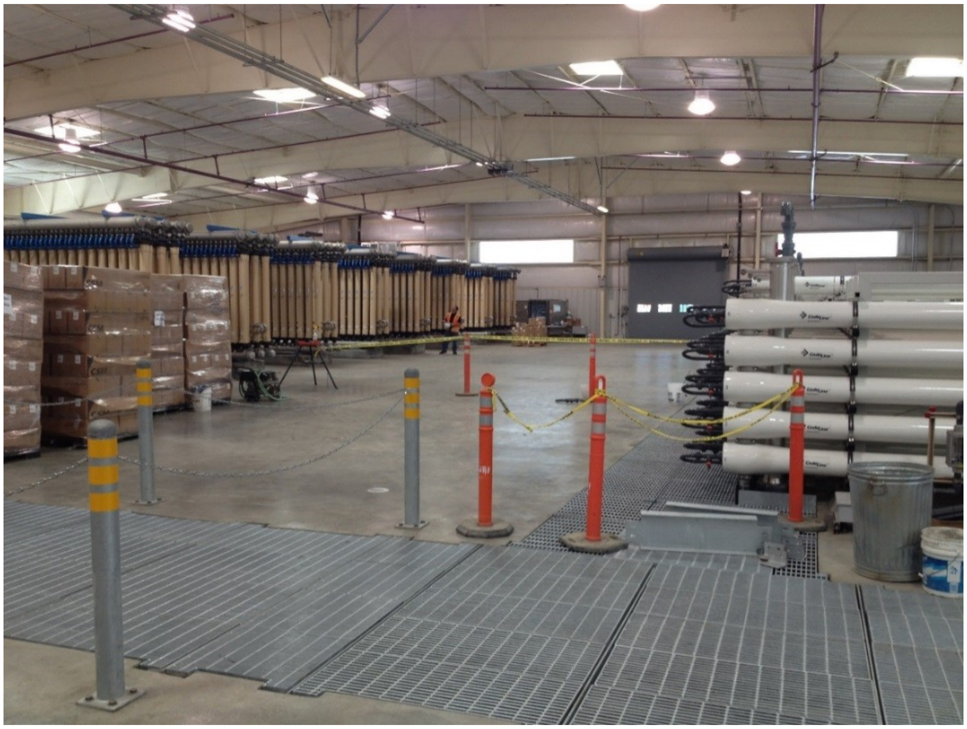
3. Engineering Considerations

This section highlights the engineering considerations involved with implementing a fast track pipeline, including the use of the existing SVAWPC to supply recycled water, what recycled water capacity would be available, potential pipe materials for the temporary pipeline, and the construction issues impacting temporary versus permanent construction methods, including tunneling/boring for road crossings,

3.1 Silicon Valley Advanced Water Purification Center (SVAWPC) Impacts

The existing SVAWPC is now in operation (see Figure 3-1). The purpose of the SVAWPC is to reduce the salt concentration in the SBWR system to approximately 500 mg/L. The facility is located adjacent to the San José/Santa Clara Water Reclamation Plant. The capacity of the plant is currently 8 mgd, with space to add an additional RO train to increase the capacity to 9 mgd of plant effluent.

Figure 3-1: Silicon Valley Advanced Water Purification Center



To implement a fast track project quickly, there isn't time to construct new advanced treatment capacity. Therefore, one idea being considered is to repurpose the SVAWPC plant from supplying demineralized water to the SBWR distribution system to providing water to the Los Gatos ponds via the fast track project pipeline. The SVAWPC includes MF, RO, UV process as well as an existing effluent PS that pumps demineralized water into the SBWR distribution system. The product water from the SVAWPC is blended with non-potable recycled water in the SBWR system to reduce the TDS delivered to the end users. Since the demineralized water is blended with Title 22 reclaimed water, the SVAWPC product water isn't currently stabilized prior to the blending. The blending of the low TDS water with the Title 22 reclaimed water accomplishes the stabilization by adding TDS and alkalinity to the demineralized water.

To repurpose the SVAWPC to be used as a treatment system for water delivered to the Los Gatos spreading ponds now and to provide flexibility for future operations, the following modifications potentially could be required:

1. 1 mgd Expansion of RO system (optional)
2. Addition of Advanced Oxidation (optional)
3. Construction of a new PS to pump to Los Gatos
4. Stabilization of the product water at the plant
5. Operating system modifications

Also, provisions would need to be made to provide flexibility to toggle the product water between the pipeline to Los Gatos ponds and the SBWR recycled water system (TPS clear well). SBWR

RO Expansion

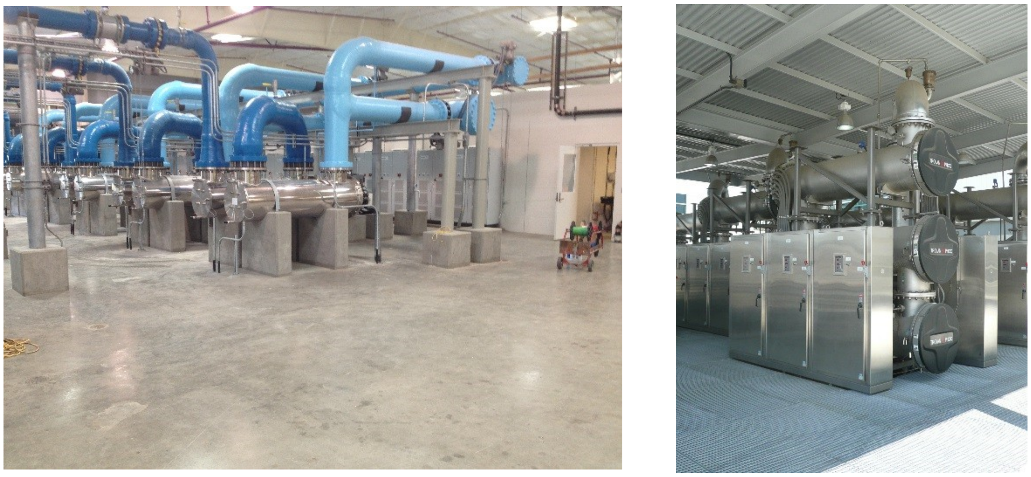
The current SVAWPC has a capacity of 8 mgd. There is space to install another 1 mgd of RO capacity, increasing the plant capacity to 9 mgd of product water. This work would be optional if the 8 mgd capacity is adequate for the fast track project. RO expansion will not be included in Fast Track project or the cost estimates in Section 5 since the District is already planning on adding this capacity.

Advanced Oxidation

An advanced oxidation (AOP) process is specifically not required by the Groundwater Reuse Regulations for "percolation" only recharge projects, so significant modifications to the existing SVAWPC disinfection system should not be required to meet the DDW requirements. AOP would be required for the future Phase 4 discharge of recycled water into injection wells because of the absence of soil aquifer treatment (SAT) that help remove TOC and CECs. The only currently permitted project to percolate AWPF water with reverse osmosis to percolation ponds is Orange County Water District's Groundwater Replenishment System which does treat the effluent with AOP prior to spreading at the percolation ponds. Since the project also includes groundwater injection, the AOP was included for the percolation discharge as well to supply to same high quality water to all of their constituents. Therefore, AOP will be considered an optional modification for the Fast Track project.. The following describes what would be needed to modify the current UV system for adding AOP in the future.

The SVAWPC currently utilizes UV to disinfect the product water prior to blending with the Title 22 non potable water. The existing UV system is similar to a UV-AOP with the exception that more UV light is needed and peroxide has to be added prior to the UV system to perform the advanced oxidation. To increase the UV light, additional vessels are required. The additional vessels are typically added above the each other to minimize space requirements. The District is already involved in testing UV-AOP at the SVAWPC so the sizing of a modified UV system will be defined from the testing. Figure 3-2 below shows the current SVAWPC UV disinfection system (left) with a single UV vessel and a similar UV-AOP system (right) with three stacked vessels. AOP costs are referenced, but will not be included in the Section 5 cost estimates.

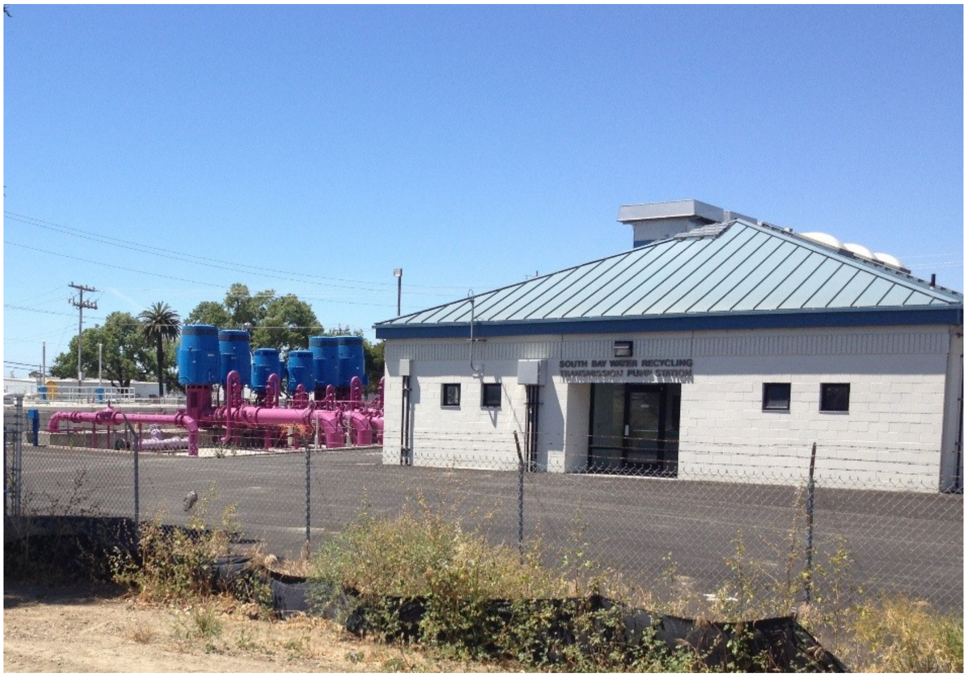
Figure 3-2: Existing UV System and UV-AOP System (Optional)



New Product Water Pump Station

A new temporary pump station constructed at the SVAWPC site adjacent to the existing SBWR transmission pump station (Figure 3-3) may be needed to allow water to be pumped to the Los Gatos ponds. With proper metering and valves at the existing pump station, it would be possible to operate both systems at the same time depending on the District's and SBWR needs.

Figure 3-3: Existing SBWR Transmission Pump Station



Product Water Stabilization

Stabilization of the SVAWPC product water using lime or a blend of sodium hydroxide/calcium chloride will be required to stabilize the water going to the Los Gatos ponds. Stabilization of the water is required by the reuse regulations and will also allow standard pipe materials as discussed below. Lime is currently used as the West Basin and the Groundwater Replenishment System projects in Southern California. The sodium hydroxide/calcium chloride chemical addition has been implemented at the just completed Leo J. Vander Lans water treatment plant in Long Beach, California. The stabilization could occur at or after the new pump station. If the water is stabilized prior to the effluent pump stations, it would not be conducive to sending water to both the SBWR and the Los Gatos ponds simultaneously. Stabilizing the water at the new pump station or after the new pump station would facilitate sending water to both systems. See Figure 3-4 for an example of a lime stabilization system and Figure 3-5 for a sodium hydroxide/calcium chloride chemical additional systems.

Figure 3-4: Lime Stabilization System

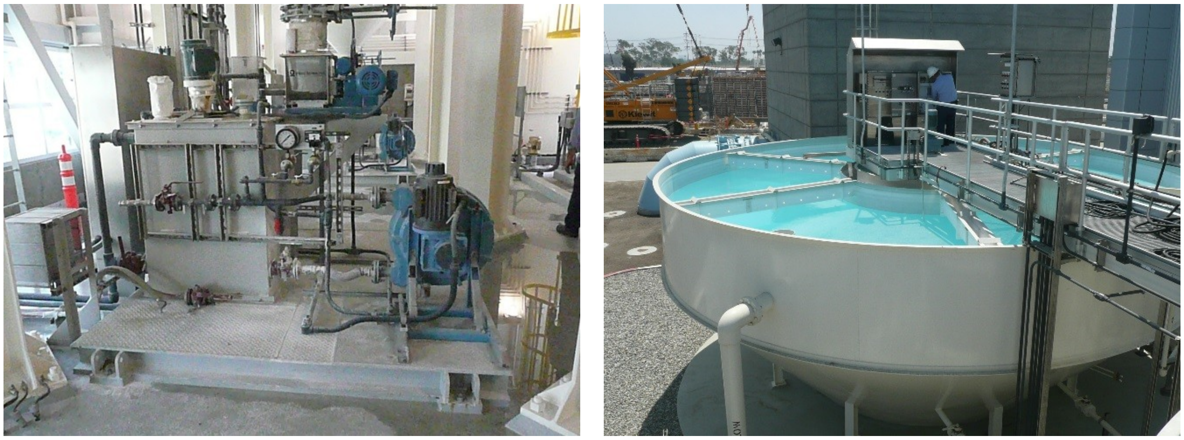
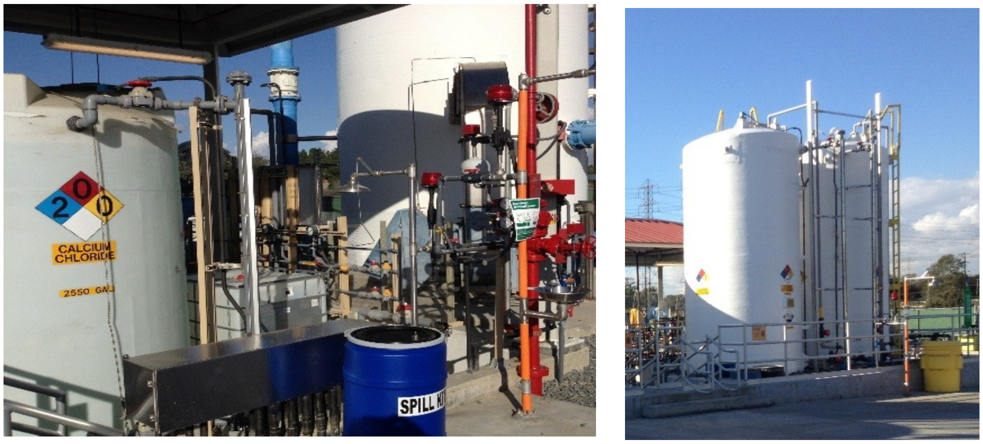


Figure 3-5 Lime Stabilization System



Plant SCADA System Modifications

Modifications to the existing SVAWPC plant operating system would be required to incorporate both the new pump station and the product water stabilization chemical systems into the existing SVAWPC. These changes should not be significant and can be seamless incorporated into the existing SCADA system.

3.2 Temporary versus Permanent Construction

The fast track pipeline could be installed as a temporary pipeline on top of the ground or as a permanent pipeline installed in the ground using conventional construction techniques. The temporary pipeline could be constructed faster because less digging would be required but an in-ground pipeline would be more permanent and reduce the chance of the pipeline being a stranded asset. Because of the fast track schedule in which this pipeline must be constructed, the temporary concept would be favored except for road crossings where alternative construction methods such as tunneling or boring will be required.

The temporary pipe could be installed above the ground with proper restraint to keep the pipe from moving when under pressure. The alignment would typically be out of a travel or bike path. For creek or river alignments, the pipeline would be best installed above the high water line or on the side of a concrete drainage channel. A temporary pipe installed below a creek or river water surface could float or be damaged by moving water in the waterway.

3.3 Capacity from the SVAWPC

The fast track pipeline could be sized for the current SVAWPC capacity of 8-9 mgd. The 9 mgd pipeline would have a nominal minimum diameter of 24-30 inches (See Section 3.4 below). This fast-track concept will include a pipeline designed for 9 mgd.

3.4 Pipe Materials (HDPE vs Aluminum vs Steel vs DIP)

Piping typically available in the 24-30 inch diameter size range required includes HDPE, fusible PVC, aluminum, steel, and ductile iron pipe (DIP). At 9 mgd (6,250 gpm) from the SVAWPC, the anticipated system pressure will be 151 psi. The minimum pipeline pressure should be 160 psi to meet this anticipated pumping head from the SVAWPC located at elevation 5 to the Los Gatos Ponds located at elevation 225.

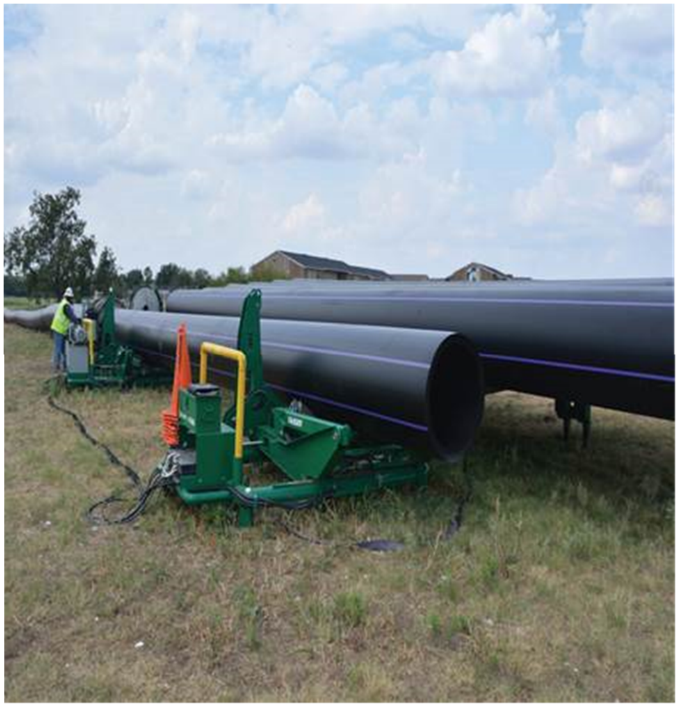
HDPE

High density polyethylene (HDPE) pipe is available from ISCO and CP Chem. The local HDPE distributor is P&F Distributors. Rain For Rent (RFR) also provides long-term leases for HDPE and aluminum pipe. For HDPE, the following material parameters apply:

- Nominal Diameter = 24 inches
- Maximum Pressure = DR 11 with a 200 psi rating (DR 17 has a max. pressure of 160 psi)
- Butt Fused Joints
- Weight = 146.80 lbs/ft
- Joint Length = 50 foot sticks
- Minimum Allowable Bending Radius = 300 feet

As with the Wichita Falls example described above, HDPE pipe can be installed above ground using fusion bonded joints as shown in Figure 3-6. Fusion bonded joints don't leak and can transmit longitudinal stresses along the pipe which reduce the design requirements for pipe restraint. HDPE pipe is also UV resistant, but would need to have appurtenances installed to mitigate the temperature elongation between daily and seasonal high and low temperatures.

Figure 3-6: HDPE Pipe Being Fused Prior to Pulling Into Place

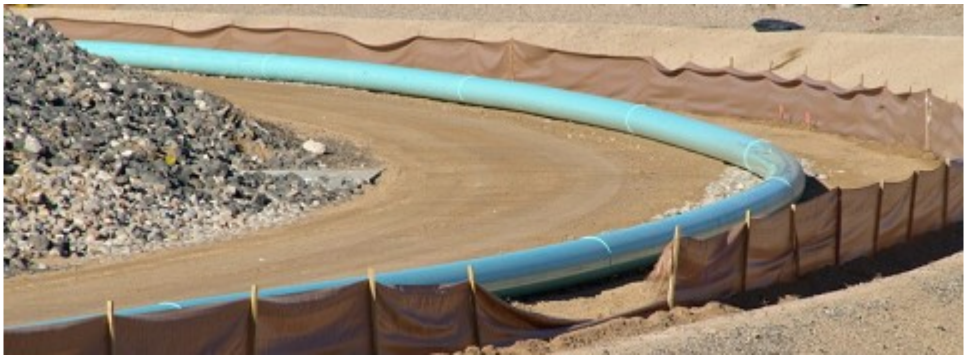


Fusible PVC

Fusible polyvinyl chloride (PVC) pipe is available from Underground Solutions, Inc. in size ranges from 4 inches to 42 inches in diameter. Fusible pipe is similar to regular PVC pipe, but has butt fused joints instead of bell type push-on joints (See Figure 3-7). The following material parameters apply:

- Inside Diameter = 29.29 inches
- Maximum Pressure = 165 psi (DR 25)
- Butt Fused Joints
- Weight = 80.14 lbs/ft
- Joint Length = 20 foot sticks
- Minimum Allowable Bending Radius = 667 feet

Figure 3-7: Fusible PVC Installed Above Ground

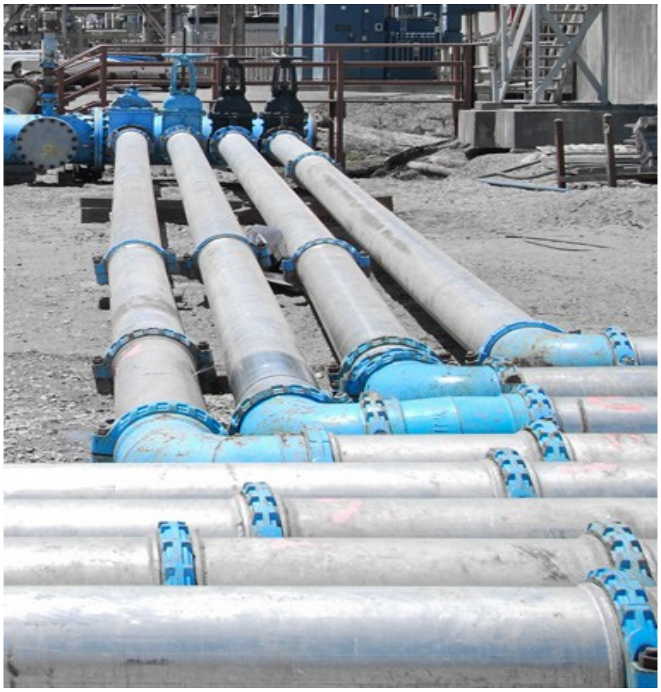


Fusion bonded PVC would have the same longitudinal restraint as HDPE but PVC pipe might need to be painted to reduce the impact of UV rays from the sun if installed above ground for long periods of time.

Aluminum

Aluminum irrigation pipe (Figure 3-8) is very light weight so it can be easily transported and set in place. Unfortunately, it has a maximum size of 12-inch diameter. The project would require three 12-inch diameter pipes to provide same capacity, or more booster pumps. The pipe is brittle and subject to vandalism. The pipe is grooved with Victaulic elbows and couplings. It has been reported the couplings can leak if not properly installed. Aluminum pipe is not recommended for the fast track project due to the potential leakage of recycled water from the joints.

Figure 3-8: "Rain for Rent" Aluminum Pipe



Steel

Welded steel pipe (WSP) is readily available in the size range required but is very heavy. For steel pipe, the following material parameters apply:

- Interior Diameter = 30”
- Wall thickness = 0.25”
- Maximum Pressure = 300 psi
- Welded, restrained gasket or flanged
- Weight = 79.5 lbs/ft (79.5 x 20 = 1590 lbs)
- Length = 20 foot sticks
- Minimum Allowable Bending Radius = 345 feet

Due to the heavy weight of the pipe, the need to weld or restrain the joints, steel pipe is more suitable for permanent installations or for tunneling and borings under road crossings.

Ductile Iron Pipe

Ductile iron pipe (DIP) is readily available in the size range required but is very heavy. For steel pipe, the following material parameters apply:

- Interior Diameter = 30”
- Maximum Pressure = 250 psi
- Restrained Gasket or Flanged
- Weight = 227 lbs/ft (3590 + 495 = 4085 lbs)
- Joint Length = 18 foot sticks
- Minimum Allowable Bending Radius = 345 feet

As with steel pipe, due to the heavy weight of the pipe, the need to restrain the joints, DIP pipe is more suitable for permanent installations.

Other

There are a variety of pipes that have self-restrained joints and locking gaskets, but they are generally limited to 16-inches in diameter and smaller. Examples are provided below, but none of these pipe types are thought to be applicable for the fast track pipeline.

Certa-Loc Yelomine. Certa-Lok Yelomine has a self-restrained joint using splines that lock the joint so that the spigot will not slide out of the rubber-gasketed bell. The maximum diameter is 16-inches but it is not readily available in the larger sizes. The pipe has a maximum pressure of 200 psi. The pipe has been used for temporary water and slurry transport in the mining industry so it is strong but somewhat brittle. The pipe comes in 40-foot long sticks.

Diamond Lok-21. Diamond Lok-21 uses a locking gasket to provide restraint but it is too small with a maximum diameter is 16”. Again this pipe is strong but is somewhat brittle.

Lay-flat Hose. Lay-flat hose would work comes in a variety of sizes, is very easy to roll out, and when flat requires little room, but would be extremely subject to vandalism.

3.5 Tunneling/HDD Under Roads/Bridges

Even though there are methods to install the fast track pipeline above ground, there are specific instances where even a temporary pipeline would need to be installed in a more permanent type of installation. This would include primarily road and stream crossings. For at grade road crossings, tunneling or boring would be required. For road crossings where there are bridges over the pipeline alignment, either the above ground installation can continue under the bridge or it might be acceptable to hang the pipe from the bridge itself.

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4. Permitting and Regulatory Considerations

This section includes a brief discussion of the permitting and regulatory considerations that could impact the implementation of a fast track pipeline and potable reuse project.

4.1 Final Groundwater Replenishment Regulations

Any fast track project to the Los Gatos ponds would need to meet the same Division of Drinking Water (DDW) requirements as any potable reuse project. The potable reuse requirements are summarized in the Strategic and Master Planning Report (RMC/CDM Smith, 2014) document prepared for the District. The primary focus of the DDW requirements is to protect public health. Regarding DDW requirements, at a minimum, there might be some opportunity for fast tracking the permit process. Due to the interim nature of this fast-track concept, DDW might be persuaded to waive the AOP portion of the requirements, recognizing that AOP is a barrier to chemical compounds (CEC's) that pose a long-term health risk, but in the shorter term do not pose an public health issue.

Groundwater modeling of the recycled water in the Los Gatos ponds would be required. If leakage of recycled water into the Los Gatos creek was shown in the modeling, then additional discharge permits would be required. As noted above, except for the addition of advanced oxidation and product water stabilization, the current SVAWPC facilities should be appropriate for percolation at the Los Gatos ponds or for injection in the adjacent area.

4.2 California Environmental Quality Act (CEQA) and NEPA

The California Environmental Quality Act (CEQA) was enacted in 1970 for the purpose of providing decision-makers and the public with information regarding environmental effects of proposed projects; identifying means of avoiding environmental damage; and disclosing to the public the reasons behind a project's approval even if it leads to environmental damage. CEQA applies only to discretionary government activities, referred to as "projects." Under CEQA, a project is defined as the whole of an action, which has the potential for resulting in either direct physical change in the environment or a reasonable foreseeable indirect physical change in the environment. Once a determination has been made that a project exists, there are three basic levels of environmental documentation:

- Exemption
- Negative Declaration (includes those with or without mitigation)
- Environmental Impact Report (EIR)

The first step of the CEQA process is to see if the proposed activities are specifically identified as being exempt from CEQA under Article 18 of the CEQA Guidelines (i.e., Statutory Exemptions) and categories of activities that are recognized under CEQA as generally having no significant effect on the environment pursuant to Article 19 of the CEQA Guidelines (i.e., Categorical Exemptions). If it can be concluded that the proposed project falls under the class of exempt projects, then an exemption from CEQA would be prepared.

However, if the Lead Agency under CEQA (the Lead Agency is the public agency which has the principal responsibility for carrying out or approving the project) determines that an exemption does not apply, then an Initial Study (IS) to support a Negative Declaration (ND) or Mitigated Negative Declaration (MND) would need to be prepared to analyze whether the implementation of the proposed project (i.e., construction and operation) would have the potential to result in a significant impact upon the environment. Should the IS analysis conclude that all impacts associated with the proposed project are less than significant or can be mitigated to a level that is less than significant, either a ND or MND can be prepared. If the IS analysis finds that the project may result in significant impacts, preparation of an EIR would be required.

4.3 Impact of Emergency Drought Proclamation

The impact of the State's emergency drought proclamation is unknown. The severity of the current drought might enable the project applicant to fast track certain permits, but it doesn't seem likely that wholesale exemptions from permits will be allowed. This could change over time, and the District's permitting group should follow what is going on in the State Legislature to ascertain the potential impacts to a fast track project.

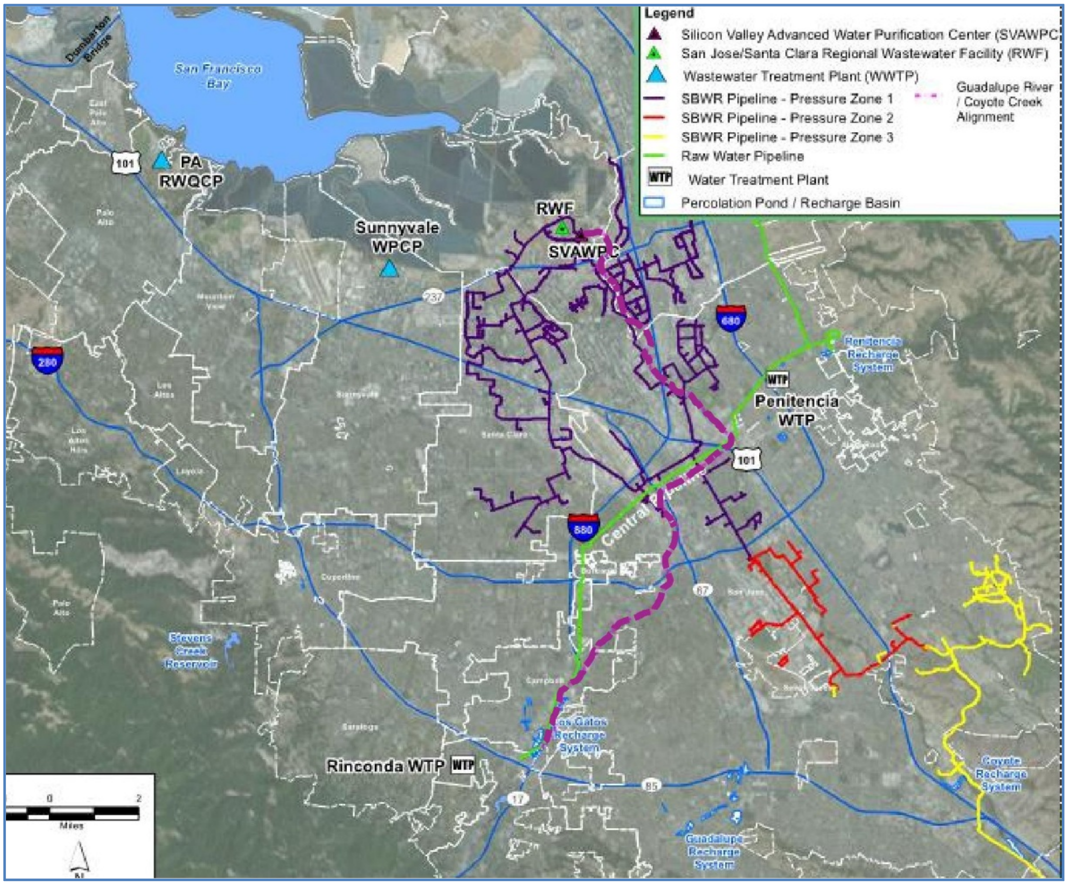
5. Conceptual Alignment Evaluation

This section provides an evaluation of the conceptual alignments for the temporary pipeline.

5.1 Coyote Creek/Los Gatos Creek

This potential alternative alignment is a stand-alone pipeline routed in the creek alignment of Coyote Creek and Los Gatos Creek. The length of the pipeline would be about 17.2 miles. The order of magnitude construction cost would be $52.9 million. The pipeline alignment is shown in Figure 5-1.

Figure 5-1: Coyote Creek / Los Gatos Creek Alignment


Legend
Silicon Valley Advanced Water Purification Center (SVAWPC
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
Guadalupe River / Coyote Creek Alignment
San Francisco Bay
Dumbarton Bridge
PA RWQCP
Sunnyvale WPCP
RWF
SVAWPC
Penitencia Recharge System
Penitencia WTP
Rinconda WTP
Los Gatos Recharge System
Stevens Creek Reservoir
Coyote Recharge System
Guadalupe Recharge System
101
280
237
680
880
87
85
17
0
2
Miles
N

From the Los Gatos Ponds the pipeline would be laid along the edge of the creek trail. The pipeline would follow Los Gatos Creek trail north, crossing under San Tomas Expressway overpass, the Highway 17 overpass, and the Highway 280 overpass at grade. The alignment would join the Guadalupe Creek Trail at John Street and Autumn Street, following Guadalupe Creek Trail north crossing under the 280 overpass to Taylor Street or Hedding Street. The pipeline would leave the trail at Taylor Street or Hedding Street, being buried in the street using open cut construction, tunneling under Highway 87 on Taylor Street or Hedding Street, traveling east on Taylor Street or Hedding Street to Highway 101. The pipe would tunnel under Highway 101 on Taylor Street or Hedding Street/Berryesa Road, traveling east on Taylor Street or Berryesa Road to Coyote Creek Trail. Turning north on the Coyote Creek Trail at grade, the pipeline would cross under the Highway 880 overcrossing, the Trimble Road overcrossing, the Tasman Drive overcrossing and the Route 237 overcrossing to McCarthy Lane at the main SJ WPCP. The pipeline would turn west on McCarthy Lane through sludge drying beds to Zanker Road where it would turn south on Zanker Road to the SVAWPC.

The advantages and disadvantages of this alignment are shown in Table 5-1.

Table 5-1: Coyote Creek / Los Gatos Creek Alignment

Advantages	Disadvantages
• Creek alignment comes up adjacent to SVAWPC • Shorter Coyote Creek alignment alternative • More public right-of-way available than Coyote Creek alignment	• Requires 2.6 miles of buried pipeline tunneling under Highways 87 and 101 • Limited trails in Coyote Creek reach • Trail and bank alignment subject to vandalism • Creek channel alignment may cause flow blockages or damage pipe • Creek channel alignment restricts maintenance access • Potential impact to trails/bike paths • Maintenance/rental cost is high - approx. $1 million per month.

5.2 Guadalupe River/Los Gatos Creek

This potential alternative alignment is a stand-alone pipeline routed in the creek alignment of Los Gatos Creek and Guadalupe River. The length of the pipeline would be about 17.8 miles. The magnitude construction cost would be $54.3 million. The pipeline alignment is shown in Figure 5-2.

From the Los Gatos Ponds the pipeline would be laid along the edge of the creek trail. The pipeline would follow Los Gatos Creek trail north, crossing under San Tomas Expressway overpass, the Highway 17 overpass, and the Highway 280 overpass at grade. The alignment would join the Guadalupe Creek Trail at John Street and Autumn Street, following Guadalupe Creek Trail north crossing under the Highway 280 overpass, the Highway 880 overpass, the Highway 101 overpass, the Trimble Road overpass, the Montague Expressway overpass, the Tasman Drive overpass, and the Route 237 overpass to El Dorado Street in Alviso. The pipeline would leave the trail at El Dorado Street, being buried in City streets using open cut construction, traveling northeast on El Dorado Street, north on 1st Street, southeast on 1st Street to Grand Blvd. At Grand Blvd, the alignment turns east on Los Esteros Road to Mike Tocce Lane, then southeast on Mike Tocce Lane, crossing Zanker Road to the SVAWPC.

The advantages and disadvantages of this alignment are shown in Table 5-2.

Figure 5-2: Guadalupe River / Los Gatos Creek Alignment

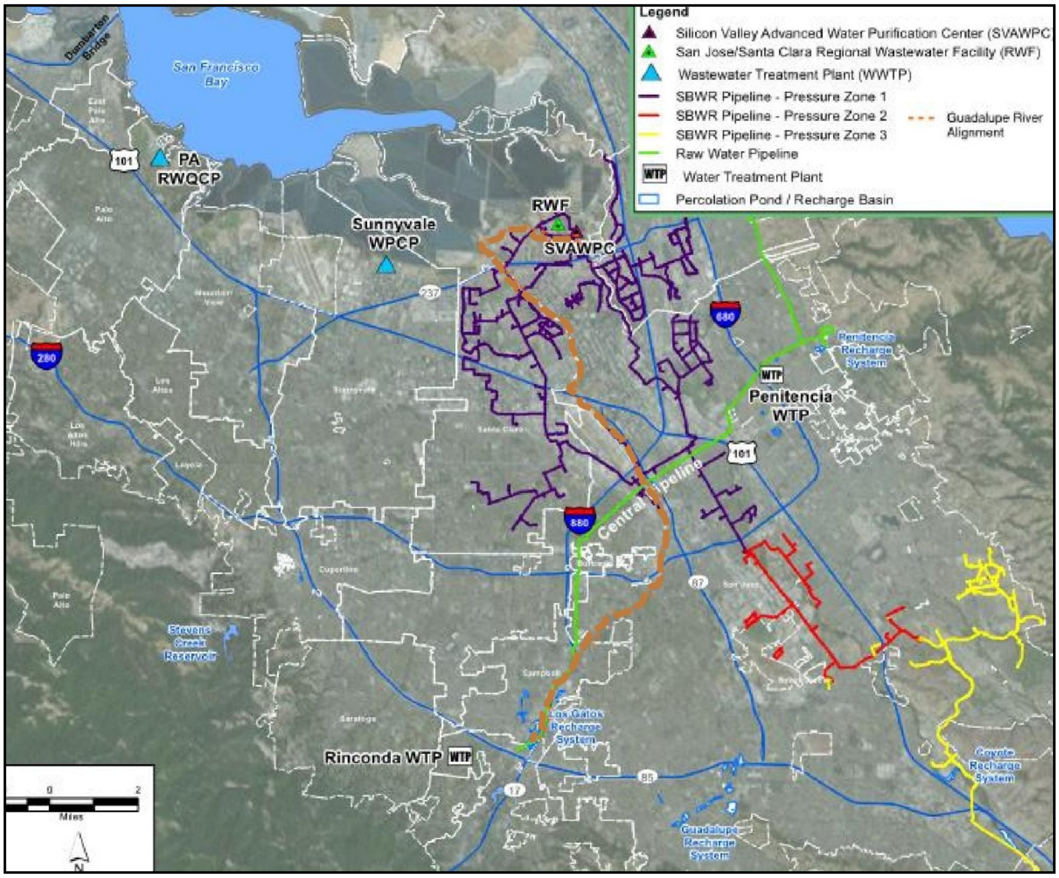

Legend
▲ Silicon Valley Advanced Water Purification Center (SVAWPC)
▲ San Jose/Santa Clara Regional Wastewater Facility (RWF)
▲ Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
Guadalupe River Alignment
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
San Francisco Bay
Dumbarton Bridge
PA RWQCP
Sunnyvale WPCP
RWF
SVAWPC
Penitencia Recharge System
Penitencia WTP
Central Pipeline
Stevens Creek Reservoir
Los Gatos Recharge System
Rinconda WTP
Coyote Recharge System
Guadalupe Recharge System
101
237
280
680
87
85
17
0
2
Miles
N

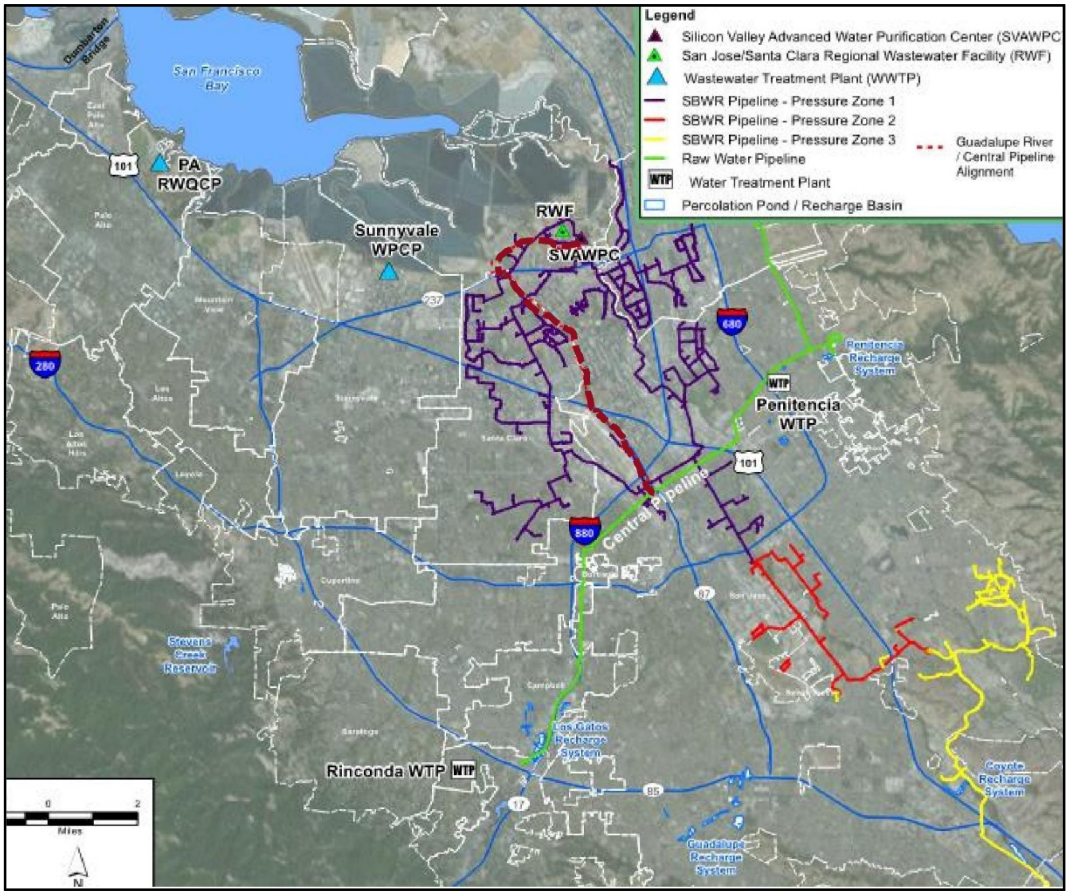
Table 5-.2: Guadalupe River/Los Gatos Creek Alignment

Advantages	Disadvantages
• Least time to implement – probably 4 months • Moderate pipe material cost - $6 to $9 million • 76% of the alignment has trails available	• Requires 2.1 miles of buried pipeline in Alviso to connect Guadalupe River alignment to SVAWPC • 24% of the alignment does not have trails available – must use cut and cover in public streets • Creek channel alignment may cause flow blockages or damage pipe • Trail and bank alignment subject to vandalism • Maintenance/rental cost is high – approx. $1 million per month.

5.3 Guadalupe River to the Central Pipeline

This potential alternative alignment is a stand-alone pipeline routed in the creek alignment of Los Gatos Creek and Guadalupe River. The length of the pipeline would be about 9.7 miles. The magnitude construction cost would be $36.3 million. The pipeline alignment is shown in Figure 5-3.

Figure 5-3: Guadalupe River/Central Pipeline Alignment


Legend
Silicon Valley Advanced Water Purification Center (SVAWPC
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
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Guadalupe River / Central Pipeline Alignment
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Sunnyvale WPCP
RWF
SVAWPC
Penitencia Recharge System
Penitencia WTP
Central Pipeline
Stevens Creek Reservoir
Los Gatos Recharge System
Rinconda WTP
Coyote Recharge System
Guadalupe Recharge System
Miles
N

The pipeline would connect to the Central Pipeline turnout at the valve structure just north of Highway 87 on the Guadalupe River Trail. The pipeline would follow Guadalupe River trail north, crossing under the Hedding Street overpass, the Highway 880 overpass, the Highway 101 overpass, the Trimble Road overpass, the Montague Expressway overpass, the Tasman Drive overpass, and the Route 237 overpass to El Dorado Street in Alviso. The pipeline would leave the trail at El Dorado Street, being buried in City streets using open cut construction, traveling northeast on El Dorado Street, north on 1st Street, southeast on 1st Street to Grand Boulevard. At Grand Boulevard. the alignment would turn east to Los Esteros Road to Mike Tocce Lane at the main WPCP, turn southeast on Mike Tocce Lane, crossing Zanker Road to the SVAWPC.

The advantages and disadvantages of this alignment are shown in Table 5-3.

Table 5-3: Guadalupe River/Central Pipeline Alignment

Advantages	Disadvantages
• Shortest new pipeline alignment • Lowest implementation cost • 80% of the alignment has trails available. • Utilizes existing infrastructure (Central Pipeline and Los Gatos outlet) • Significant existing public right-of-way • Potential Permanent Alignment	• Creek alignment is subject to vandalism. • Potential impact to trails/bike paths • Trail alignment subject to vandalism • DDW approval required for connecting recycled water pipe to Central pipeline • Maintenance/rental cost is moderate – approx. $0.5 million per month • Potential USACE permit required • Potential CDFG stream alternation permit required

5.4 San Tomas Aquino Creek

This potential alternative alignment is a stand-alone pipeline routed along street right of way in the north and in the San Tomas Aquino creek for much of the alignment.. The length of the pipeline would be about 16.4 miles. The magnitude construction cost would be $44.6 million. The pipeline alignment is shown in Figure 5-4.

The middle portion of San Tomas Aquino Creek runs under or alongside San Tomas Expressway. At Cabrillo Avenue the creek starts running under the median of the expressway until Williams Road. Some portions are partially exposed, but much is completely underground. From Williams Road the creek runs along the west side of the expressway until Bucknall Road. From there it leaves the expressway and enters the hills. The San Tomas Aquino bike trail follows the creek from the Bay to El Camino Real Avenue.

The advantages and disadvantages of this alignment are shown in Table 5-4.

Figure 5-4: San Tomas Aquino Creek Alignment

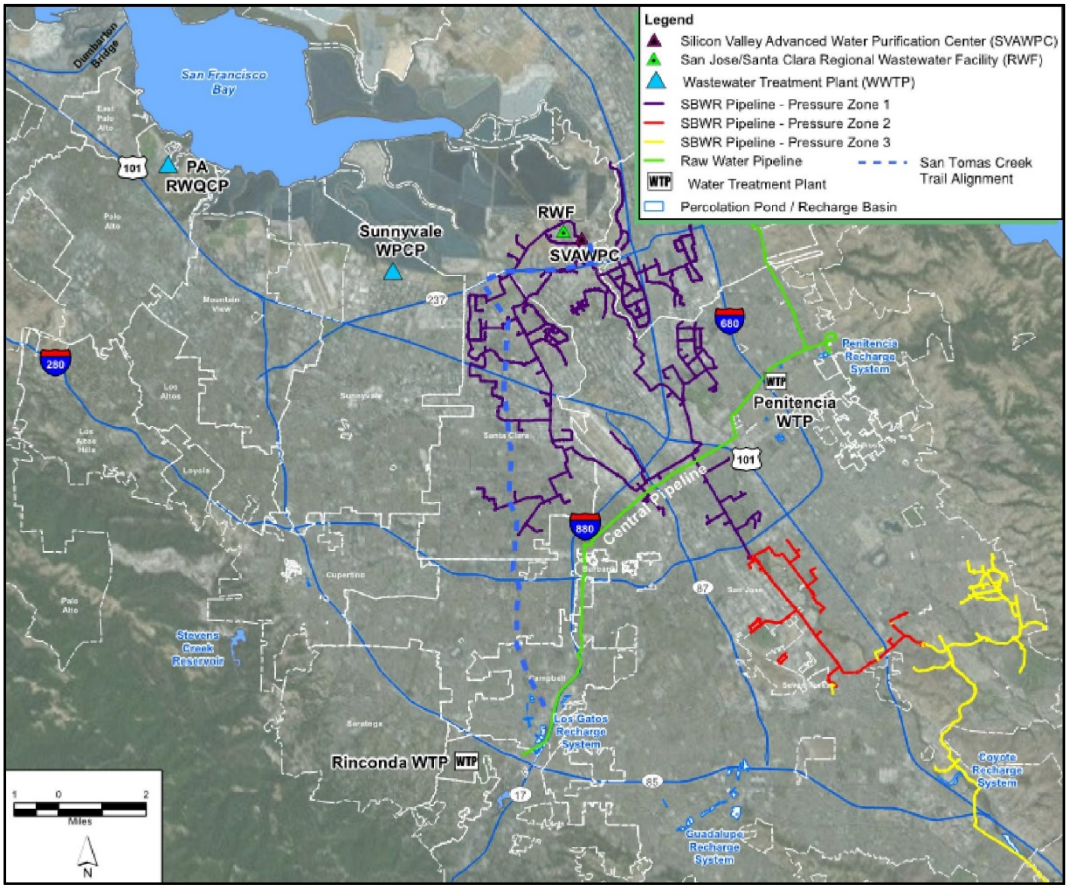

Legend
Silicon Valley Advanced Water Purification Center (SVAWPC)
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
San Tomas Creek Trail Alignment
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
Dumbarton Bridge
San Francisco Bay
PA RWQCP
Sunnyvale WPCP
RWF
SVAWPC
Penitencia Recharge System
Penitencia WTP
Central Pipeline
Stevens Creek Reservoir
Los Gatos Recharge System
Rinconda WTP
Coyote Recharge System
Guadalupe Recharge System
101
237
280
680
880
87
85
17
1 0 2
Miles
N

Table 5-4: San Tomas Aquino Creek Alignment

Advantages	Disadvantages
• Shorter time to implement – probably 4 to 6 months. • Moderate pipe material cost - $6 to $9 million • 30% of the alignment has trails available • Option to stop at mid-basin injection zone • 70% of the alignment has potential maintenance access road available • Closer to Santa Clara mid basin injection • Less potential for public impact • Not listed as a USACOE Navigable Waterway • No CWA 404 permit required	• Requires confined space construction in storm drain conduit under freeway • South of Budd Ave will require some buried construction to Los Gatos ponds • Storm drain channel alignment may cause flow blockages or damage pipe • Storm Drain alignment subject to vandalism

5.5 Existing SBWR NPR System/Public Streets

This potential alternative alignment is a combination of existing SBWR pipelines and a new stand-alone pipeline from the existing SBWR system to the Los Gatos ponds. Conceptually, this alternative alignment would use a portion of the existing SBWR NPR system to convey the 9 mgd of SVAWPC water directly to a new pipeline and on to the Los Gatos ponds for potable reuse. The Los Gatos pipeline connection could be made at either the intersection of Mission St and 4th St or at the intersection of Senter Road and Alma Ave. Approximately 8.5 miles of the SBWR transmission main would need to be re-purposed. The dedicated portion of the SBWR distribution system would also need to be isolated from the rest of the SBWR system which would continue to serve current demands using T22 water without the current partial demineralization.

If this portion of the SBWR distribution system is repurposed, then the existing demands along the pipeline could be supplied with the highly purified water from the SVAWPC or would need to revert to their backup potable supply.

If the SVAWPC could serve the demands of both the NPR and Los Gatos IPR program, then the water quality served to the NPR customers would be impacted since the water quality would change from the current T22 reclaimed water with a TDS of about 500 mg/L to the stabilized SVAWPC water with a TDS below 100 mg/L. For customers in the remainder of the SBWR system, the TDS would rise to 700-750 mg/L because there wouldn’t be any partial demineralization from the SVAWPC.

A booster pump station may be required to pump the water from the SBWR connection to the Los Gatos ponds. The SBWR Zone 1 low water level hydraulic elevation at the connection would be approximately elevation 230 while the Los Gatos ponds also have an elevation of about 230. The repurposed pipeline would also need to be dedicated for a set period of time and couldn’t be switched from one source to another because of potential issues with changing water quality, flushing of the pipeline, and other regulatory requirements that might be included in the reuse permit.

There are no creeks or rivers that would connect the SBWR system to the Los Gatos ponds, therefore a new buried pipeline could need to be constructed from the turnout on Senter Road to the ponds. The alignment would be buried using open cut construction or tunneled. The pipeline would connect to the Los Gatos Pond discharge and travel west on Division Street to Winchester Boulevard. The alignment would turn north on Winchester Boulevard to Hamilton Avenue, turn east on Hamilton Avenue to Meridian Avenue, cross Los Gatos creek with a trenchless crossing or attached to the Hamilton Avenue bridge, continue on Hamilton Avenue to Meridian Avenue, turn north on Meridian Avenue to Minnesota Avenue, turn east on Minnesota Avenue (West Alma Avenue) with a trenchless crossing under Highway 87 and Monterey Road. The proposed connection to the 42-inch SBWR would be at intersection of Senter Road and Keyes Street or intersection of Senter Road and West Alma Avenue. North of Highway 280, the 42” SBWR pipeline is deep and was installed in a tunneled casing on 4th Street.

The advantages and disadvantages of this alignment are shown in Table 5-5.

Figure 5-5: Existing SBWR NPR System/Public Streets

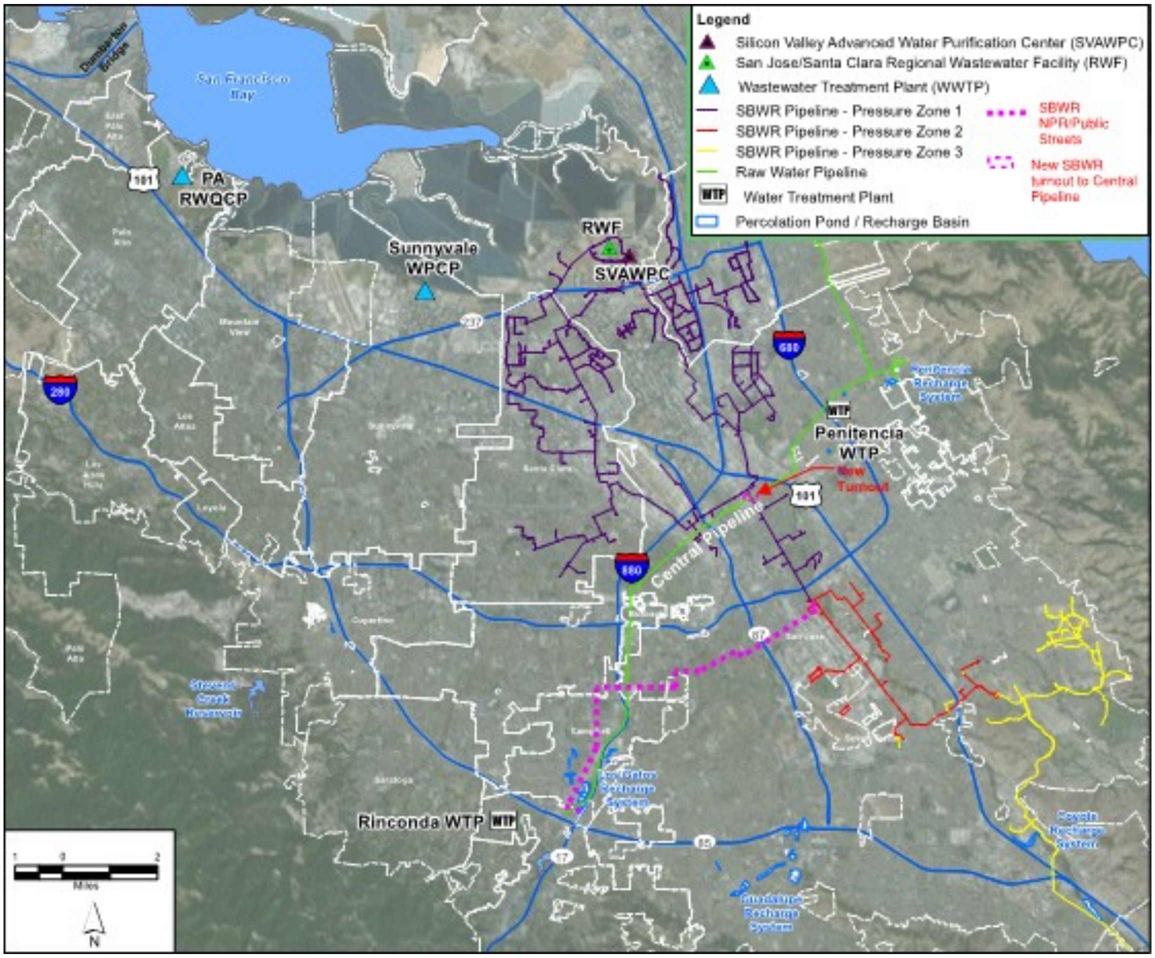

Legend
Silicon Valley Advanced Water Purification Center (SVAWPC)
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
SBWR NPR/Public Streets
New SBWR turnout to Central Pipeline
Dumbarton Bridge
San Francisco Bay
PA RWQCP
Sunnyvale WPCP
RWF
SVAWPC
Penitencia WTP
New Turnout
Central Pipeline
Rinconda WTP
101
237
280
680
880
17
85
Miles
N

Table 5-5: Existing SBWR NPR System/Public Streets Alignment

Advantages	Disadvantages
• No stranded assets • Minimal maintenance cost • Minimal rental cost (pump station only) • Buried pipe is not subject to vandalism	• Requires repurposing of SBWR pipelines and would impact demands along the pipeline • Requires a permanent installation • Would not support a long term potable program due to SBWR system impacts • Long time to implement – up to 2 years. • Water quality changes could impact SBWR customer's process operations • Not flexible to switching SVAWPC between potable reuse/SBWR system salinity control • Not suitable for temporary construction due to multiple road crossings/tunneling • Significant traffic impacts

Switching the SBWR pipeline back and forth from SVAWPC flow to SBWR flow would impact the TDS of the water supplied to the customers. Typically recycled water customers want consistent water quality to minimize the impact to their operations. Switching the water source could also impact the pipeline operation, as DDW may require flushing or additional monitoring.

Because of the complexity and potential regulatory issues, this alternative isn't considered viable for the fast track project.

5.6 Conceptual Pipeline Costs

The pipeline rental costs, material costs and other issues that can impact the pipeline construction costs are highlighted below.

Pipeline and Pump Station Rental Costs

Rain For Rent (RFR), a company that supplies pipe and pumping equipment for temporary installations like the fast track project concept evaluated in this TM was contacted to discuss whether it would be better to purchase or rent the pipe and pump station equipment. RFR suggested a long term lease as the best method to provide and install the pumps and the HDPE pipe on a rental contract basis. There would be a significant cost for mobilization and demobilization, but a company such as RFR can set up and start laying pipe in less than a month. The rental approach is expensive but can save a lot of time as compared to conventional construction contracting as the pipeline would not have to be fully designed, bid, and awarded as construction contract. The work could also be done on an emergency basis.

RFR's estimate was in the range of $6 to $9 million for a 24 inch diameter DR17 HDPE pipe, 94,000 feet long, with 3 diesel booster pumps. This assumes a minimum 3 to 4 month rental, with each month beyond the initial period costing about $1 million. RFR estimated that the construction duration would be 48 days, with a crew of three, 11 man fusion crews. For above ground installations, constructing the joints takes the longest time. For HDPE, The standard heating and cooling cycle is 45 minutes. Assuming one weld every 50 feet (since the sticks of pipe are 50 feet long), the welding process alone would take approximately 1,410 hours or about 35 crew days.

Pipe Material Purchase Costs

Purchasing the pipe directly would be much more expensive. P&F Distributors was contacted and asked to provide a quote for the HDPE pipe material. The HDPE pipe material alone would cost approximately $17 million or about $8/inch/diameter/foot including tax and freight. The pipe is not an off-the-shelf item. The fabrication of the HDPE pipe could begin within two weeks after an order is placed, with shipment of the pipe about three to four days after production starts.

Other Pipeline Costs

Other items to be considered in the construction costs for the various pipelines are the cost of installing the pipeline via open trench method, tunneling costs using horizontal directional drilling (HDD) construction at the various trenchless crossings, constructing around the existing utilities, and construction of an access road over the pipe in the areas where public rights-of-way are not available.

5.7 Fast Track Project Construction Costs

Conceptual project costs were estimated for each of the alternative alignments described below. Table 5-6 summarizes the costs.

Table 5-6: Magnitude Fast Track Project Construction Costs

Item [1]	Coyote Los Gatos ($M)	Guadalupe Los Gatos ($M)	Guadalupe Central Pipe ($M)	San Tomas Aquino ($M)	Repurposed SBWR ($M)
Stabilization	0.9	0.9	0.9	0.9	0.9
Pump Sta.	4.5	4.5	4.5	4.5	4.5
SBWR Connection	-	-	-	-	2.5
Pipe	30.5	31.6	17.2	24.0	21.5
Subtotal	35.9	37.0	22.6	29.4	29.4
Cont. (25%)	9.0	9.3	5.7	7.4	7.4
Total	44.9	46.3	28.3	36.8	36.8

Notes: (1) Optional costs would include $2M for 1 mgd of RO capacity and $4M for UV-AOP.

6. Alignment Evaluation

6.1 Initial Screening Criteria

A meeting was held on October 27, 2014 to discuss the alternative alignments. The most significant findings were the following:

- The fast track project might be critical if the drought continues, but the need for an emergency construction determination to potentially get relief from the regulatory and permitting requirements was not well substantiated at this time and needed further discussion.
- The alignments that use the existing public streets were the least desirable due to the high cost, the longer durations associated with the permanent pipeline construction through public streets, and the greater impacts to the community.
- The Los Gatos Creek alignments had lengths where the creek is undeveloped and no bike or walking path. Construction in these areas was considered to potentially have a significant impact on the environment and more unknowns for the right-of-way.
- Purchasing the pipe was thought to be a better option at this time because the length of time the project would be needed is unknown.
- The temporary project would only be designed for the capacity of the SVAWPC with the building out of the RO in the existing building.
- While construction along the bike paths of the Guadalupe River would have an impact on the area’s recreational activities, it was thought that the space for construction and existing right-of-way offered significant advantages and the community impacts could be mitigated.
- The San Tomas Aquino Creek and SBWR NPR alternatives should be investigated.

Based on the discussions at this meeting and follow-on conversations afterwards with District staff, the District determined that the Guadalupe River to the Central Pipeline and the San Tomas Aquino Creek alignments offered the best opportunities to implement a fast track temporary pipeline if needed.

The issues associated with the Guadalupe River and the San Tomas Aquino Creek alignments are discussed in more detail below.

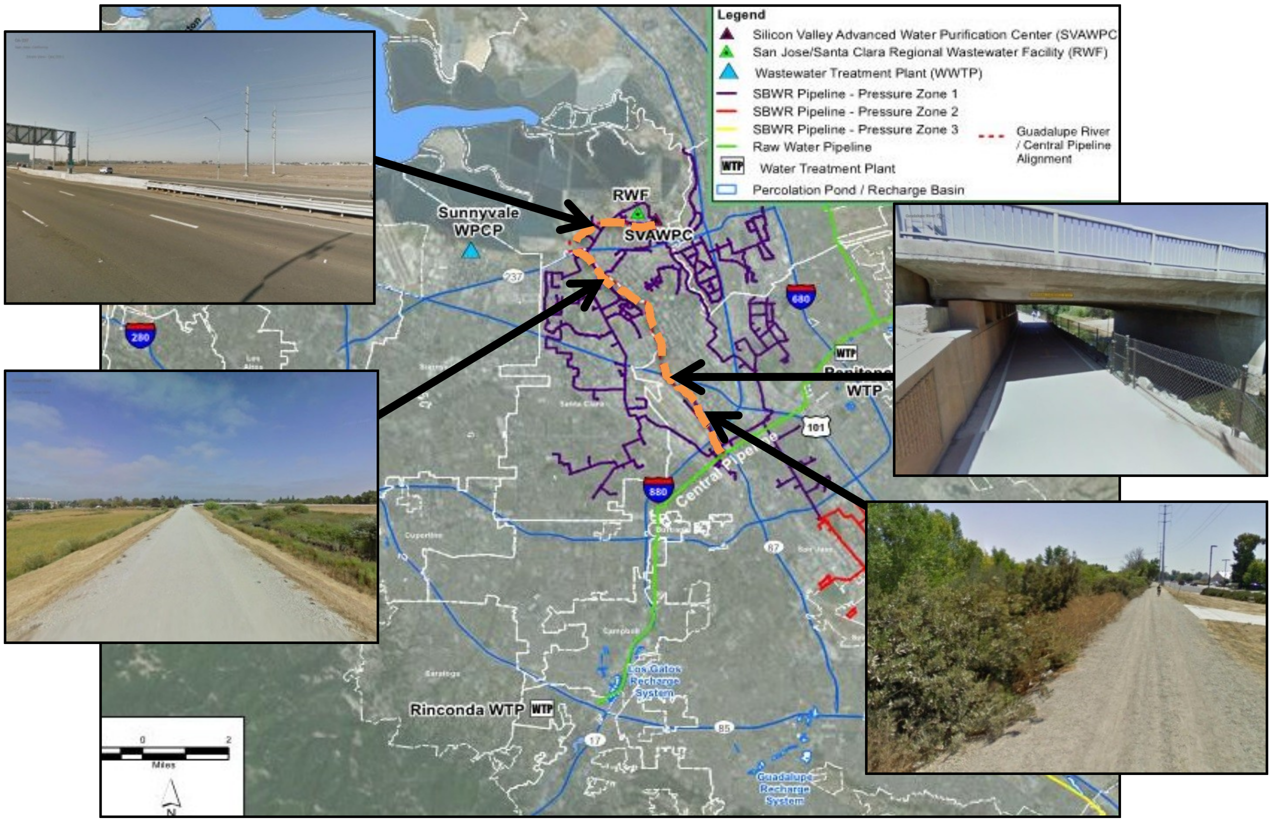
Guadalupe River-Central Pipeline Alignment

Above-ground construction may be possible for the Guadalupe River/Central Pipeline alignment where it was considered infeasible for the in-street or existing SBWR pipeline alignments. This alignment is the shortest and has the lowest cost. The intent for the above ground construction would to use the bike or walking trail wherever it is available. The trail alignments would be a fairly easy installation since there is often open space with good access for materials and equipment. There would be some operational issues such as protection of the pipe from vandalism and sunlight degradation if PVC pipe material was used.

There will also community impact issues to consider, such as creek access and public access trails that would be blocked by a large diameter installed above ground pipe. Building a ramp over the pipe may not be feasible. It may also be necessary to bury the pipe at these crossings in addition to the road crossings. Channel slope or bank installation would be more difficult where bike or walking trails are not available but fortunately, most of the Guadalupe River alignment has adequate space to construct the pipe. There are also bridges over the river for the road crossings, making construction below the bridges possible without tunneling or borings. This alignment is estimated to have seven major intersection crossings.

Figure 6-1 shows the Guadalupe River-Central Pipeline Alignment along with photos highlighting some of the existing features that will be encountered along the pipe route.

Figure 6-1: Guadalupe River to the Central Pipeline Alignment Features


Legend
Silicon Valley Advanced Water Purification Center (SVAWPC
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
Guadalupe River / Central Pipeline Alignment
RWF
SVAWPC
Sunnyvale WPCP
Penitencia WTP
Central Pipeline
Rinconda WTP
Los Gatos Recharge System
Guadalupe Recharge System
280
680
880
101
237
85
17
87
0
2
Miles
N

San Tomas Aquino Creek Concept

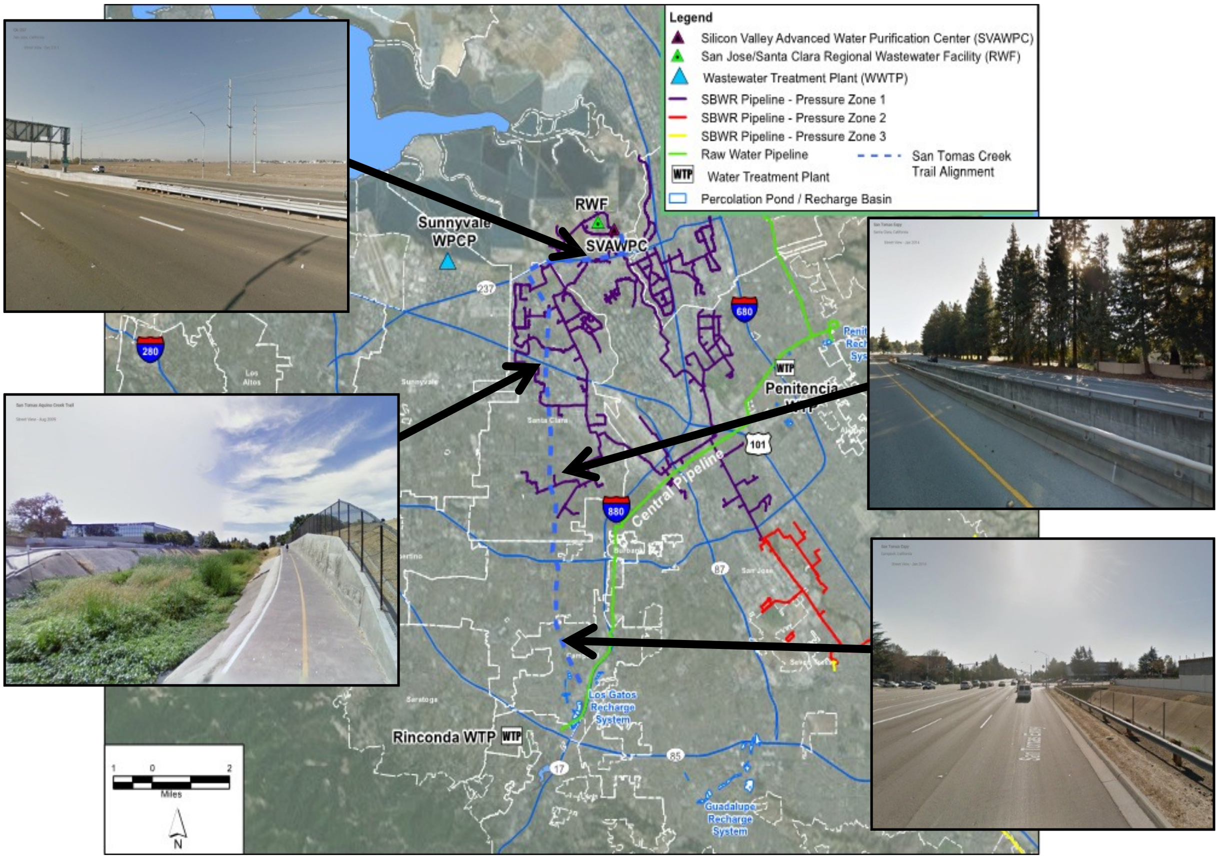
The San Tomas Aquino Creek alignment was recommended for further consideration because it has existing right of way for most of the route with continuous right-of-way from the South Bay Freeway almost all the way to the Los Gatos ponds. The San Tomas Aquino Creek alignment would have the advantage of relatively short construction duration, though access to the construction area in the median of the highway would be relatively more difficult.

The concrete channel bottom also provides a firm base to construct the pipe. The pipe could be temporarily located at the bottom of the channel, but the hydraulic impacts on San Tomas Aquino Creek could be significant in wet weather events, and the pipeline could act as a debris trap during flooding. If necessary to avoid the stormwater flow in the channel, the pipeline could be hung from the side walls of the channel above the flow. These impacts aside, this alignment would have relatively less significant impacts on the community and public perception as this alignment has limited access for much of the route. The alignment across Caltrans easements is largely in areas not normally accessed by the public.

The cost is higher than the Guadalupe River/Central Pipeline alignment, but has less impact on the community, doesn't impact the operation of the Central Pipeline, and has the second lowest construction cost.

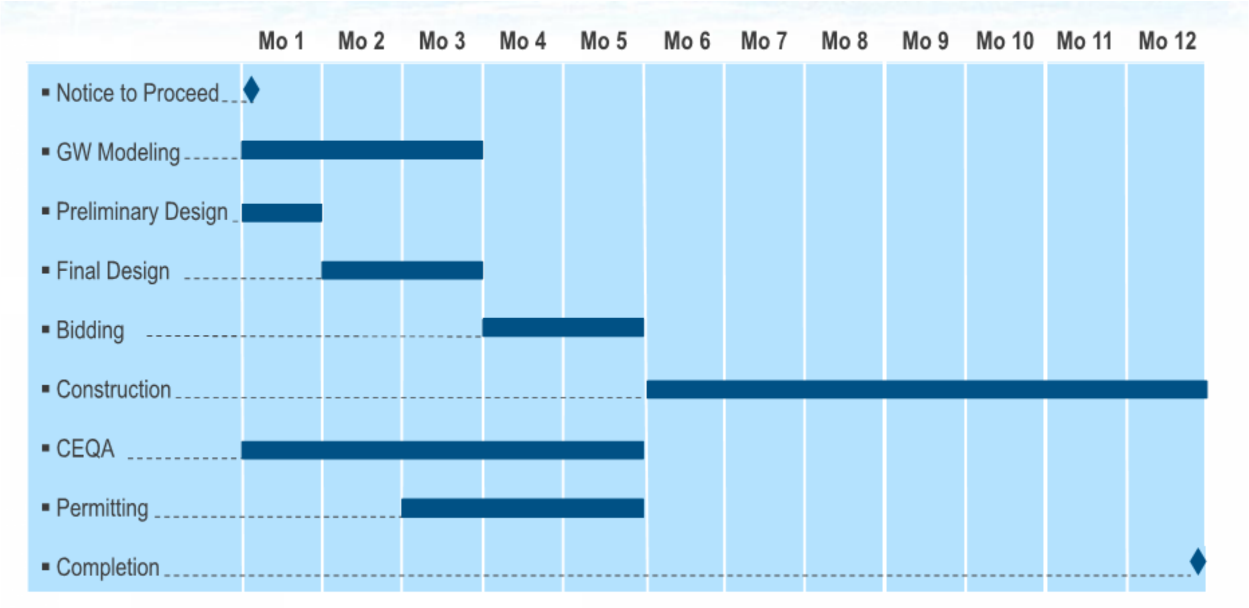
Figure 6-2 shows the San Tomas Aquino Creek Alignment along with photos highlighting some of the existing features that will be encountered along the pipe route.

Figure 6-2: San Tomas Aquino Creek Alignment Features


Legend
Silicon Valley Advanced Water Purification Center (SVAWPC)
San Jose/Santa Clara Regional Wastewater Facility (RWF)
Wastewater Treatment Plant (WWTP)
SBWR Pipeline - Pressure Zone 1
SBWR Pipeline - Pressure Zone 2
SBWR Pipeline - Pressure Zone 3
Raw Water Pipeline
San Tomas Creek Trail Alignment
WTP Water Treatment Plant
Percolation Pond / Recharge Basin
RWF
SVAWPC
Sunnyvale WPCP
237
680
280
Los Altos
Sunnyvale
Santa Clara
WTP
Penitencia
101
880
Central Pipeline
87
San Jose
85
17
Saratoga
Los Gatos Recharge System
Rinconda WTP
Guadalupe Recharge System
1 0 2
Miles
N

6.2 Project Schedule

A preliminary project schedule is presented below for a temporary, fast track project.



Appendix 8D - Recommended Potable Plan Cost Estimate

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Project: SBWR Strategic and Master Plan

Component: Phase 1 - Ford Pond IPR

Date: August 1, 2014
Updated: December 5, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 4.0 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 9,094,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 2,820,000	
15 - Mechanical	$ 30,000	
16 - Electrical	$ -	
17- I&C	$ -	

	RAW CONSTRUCTION COST	**$ 11,944,000**	
Construction Contingency	20%	$ 2,389,000	
	Satellite AWPF	$ 23,000,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 37,333,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 11,200,000	
Easements		$ 56,000	
Project Contingency	10%	$ 4,859,000	
Sanitary Sewer/Treatment Plant Connection Fee		$ 4,000,000	Allowance based on MEC connection fees
Land Acquisition Cost		$ 6,957,000	Land cost for 20 acres
	TOTAL PROJECT COST	**$ 64,405,000**	(15 acres ponds and 5 acres AWPF) Land cost based on District's Coyote IPR TM (TM 8A) $8m for 18 acres of pond and 5 acres for an AWPF

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 9,094,000**	
	Source pipeline	14	in	3,696	LF	$ 16.00	$ 828,000	Pipeline from Silver Creek Pipeline
	Product pipeline	14	in	9,504	LF	$ 16.00	$ 2,129,000	Pipeline to Ford Ponds
	Discharge sewer	8	in	2,640	LF	$ 16.00	$ 338,000	Sewer for AWPF waste
	Railroad crossings (x1)	8	in	100	LF	$ 30.00	$ 24,000	Railroad crossing between Great Oaks
	Railroad crossings (x1)	14	in	100	LF	$ 30.00	$ 42,000	Blvd and Monterey Rd for all pipelines.
	Railroad crossings (x1)	14	in	100	LF	$ 30.00	$ 42,000	Assume share bore and jack pit for all
	Bore & Jack Pits	-	-	6	EA	$ 91,400.00	$ 548,000	three crossings
	Ford Ponds site	15	ac	205,700	CU YD	$ 25.00	$ 5,143,000	Civil sitework allowance for creating new
							$ -	ponds and berms (85% of 15 total acres, 10 ft deep)
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	

Project: **SBWR Strategic and Master Plan**

Date: August 1, 2014
Updated: December 5, 2014

Component: Phase 1 - Ford Pond IPR

Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 4.0 mgd
Estimate Type: Conceptual Planning

11 - Equipment							**$ 2,820,000**	
	AOP System	4.0	mgd	1	LS	$ 1,898,695.51	$ 1,899,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 285,000	
	PWPS	75	hp	1	EA	$ 8,476	$ 636,000	Pump station to Ford Ponds
15 - Mechanical							**$ 30,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 29,963	$ 30,000	Adapted from similar project.
16 - Electrical							**$ -**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					Included in Satellite AWPF cost	$ -	
17 - I&C							**$ -**	
I&C Allowance	10% of Division 11 (Equipment)					Included in Satellite AWPF cost	$ -	
EASEMENT ACQUISITION							**Total Cost**	
	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 56,000**	
	8" pipeline	8	in	2,640	LF	$ 4.60	$ 12,000	Sewer easement on Great Oaks
	14" pipeline	14	in	9,504	LF	$ 4.60	$ 44,000	Pipeline easement to Ford Ponds
ANNUAL O&M COSTS				**Amount**	**Unit**	**Value**	**Cost**	
Consumables						Total Consumables	**$ 601,000**	
	Equipment Consumables			$ 21,986,667		2%	$600,000	2% of Equipment
	Mechanical Consumables			$ 30,000		2%	$ 1,000	2% of Mechanical
	Instrumentation Consumables			$ -		2%	$ -	2% of Instrumentation
Power Costs						Total Power	**$ 871,000**	
	Satellite AWPF				Horsepower			
					Hours per year operation			
					Annual Cost		$ 719,000	Adapted from District's TM 8A
	PWPS				Horsepower	75		
					Hours per year operation	8,059		
					Annual Cost		$ 68,000	Pumping to Ford Ponds for recharge
	AOP				Horsepower			
					Hours per year operation			
					Annual Cost		$ 84,000	Adpated from similar FAT project
Chemicals						Total Chemicals	**$ 344,000**	
	AWPF Chemicals						$344,000	Adapted from District's TM 8A + AOP from similar
							$ -	FAT project
							$ -	
Labor Costs						Total Labor	**$ 900,000**	
	Total # Operators				number			
	Average Annual Hours per operator				hrs/yr			
	Total Operators per year			0	Total hrs	$ 75	$900,000	Adapted from District's TM 8A
Other Costs						Total Other	**$ 1,392,000**	
	Annual Sewer Discharge Fee						$ 1,392,000	San Jose Industrial Discharge Sewer Fee
	SBWR Water			5,600	AFY		$ -	TBD
	Recharge Pond O&M							TBD
				TOTAL ANNUAL O&M COSTS			**$ 4,108,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 2 - Mid-Basin Injection Wells IPR

Date: August 1, 2014
Updated: December 5, 2014

Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 5.3 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ 19,533,000	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ 15,907,000	
15 - Mechanical		$ 63,000	
16 - Electrical		$ 3,181,000	
17- I&C		$ 1,591,000	
	RAW CONSTRUCTION COST	**$ 40,275,000**	
Construction Contingency	20%	$ 8,055,000	
	Centralized AWPF	$ 30,585,106	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 78,915,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 23,675,000	
Easements		$ 106,000	
Project Contingency	10%	$ 10,270,000	
Land Acquisition Cost		$ 7,691,000	Adapted from District's TM.8C, which estimated that 21 acres of land acquisition cost $17.1M.
	TOTAL PROJECT COST	**$ 120,657,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 19,533,000**	
	Product pipeline	42	in	17,000	LF	$ 16.00	$ 11,424,000	Trenched 42" line towards Los Gatos
	Lateral pipeline	18	in	23,000	LF	$ 16.00	$ 6,624,000	Trenched connection to mid-basin wells
	42" hwy x'ings (x1)	42	in	250	LF	$ 30.00	$ 315,000	Trenchless, adapted from TM 8B
	18" hwy x'ings (x1)	18	in	250	LF	$ 30.00	$ 135,000	Trenchless, adapted from TM 8B
	18" river x'ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless, adapted from TM 8B
	Bore & Jack Pits	-	-	6	EA	$ 91,400.00	$ 548,000	
	Wells laterals	8	in	1,500	LF	$ 16.00	$ 24,000	
	Backflush piping	8	in	2,560	LF	$ 16.00	$ 328,000	Adapted on District's TM.8C
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 15,907,000**	
	PWPS	200	hp	1	EA	$ 5,954	$ 1,191,000	Pump station to mid-basin injection
	Injection wells	-	-	9	EA	$ 1,350,000	$ 12,150,000	Adapted from TM.8C costs w/o contingency
	AOP system	-	-	1	LS	$ 2,566,447	$ 2,566,000	Adapted from project with similar capacity

Project: SBWR Strategic and Master Plan

Component: Phase 2 - Mid-Basin Injection Wells IPR

Date: August 1, 2014
Updated: December 5, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 5.3 mgd
Estimate Type: Conceptual Planning

	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	
15 - Mechanical							**$ 63,000**	
	Hydrogen peroxide tank & pumps			1	EA	$ 39,894	$ 40,000	Adapted from similar project.
	H2O2 Mechanical/Piping Allowance					25%	$ 10,000	
	H2O2 Installation Allowances					15%	$ 6,000	
	H2O2 Building/Canopies Allowance					18%	$ 7,000	
16 - Electrical							**$ 3,181,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 3,181,000	
17 - I&C							**$ 1,591,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 1,591,000	
EASEMENT ACQUISITION							**Total Cost**	
	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 106,000**	
	18" pipeline	18	in	23,000	LF	$ 4.60	$ 106,000	Lateral to mid-basin well field
							$ -	from main alignmment to Los Gatos

ANNUAL O&M COSTS		**Amount**	**Unit**	**Value**	**Cost**	
Consumables				Total Consumables	**$ 393,000**	
	Equipment Consumables	$ 15,907,000		2%	$ 391,000	2% of Equipment
	Mechanical Consumables	$ 63,000		2%	$ 1,000	2% of Mechanical
	Instrumentation Consumables	$ 1,591,000		2%	$ 1,000	2% of Instrumentation
Power Costs				Total Power	**$ 1,190,000**	
	AWPF		Horsepower			
			Hours per year operation			
			Annual Cost		$ 1,064,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	200		
			Hours per year operation	3,465		
			Annual Cost		$ 77,000	
	AOP		Horsepower			
			Hours per year operation			
			Annual Cost		$ 49,000	Adpated from similar FAT project
Chemicals				Total Chemicals	**$ 345,000**	
	AOP H_2O_2	24,631	gal	$ 5.60	$ 59,000	Adpated from similar FAT project
	AWPF Chemicals				$ 286,000	Adapted from SVAWPC Engineer's Report
					$ -	
Labor Costs				Total Labor	$ 780,000	
	Total # Operators	5	number			
	Average Annual Hours per operator	2080	hrs/yr			
	Total Operators per year	10400	Total hrs	$ 75	**$ 780,000**	
Other Costs				Total Other	**$ 675,000**	
	RWF Secondary Effluent	0	AFY		$ -	Assume no cost
	Injection well O&M	9	number	$ 75,000.00	$ 675,000	Adapated from similar injection project
		TOTAL ANNUAL O&M COSTS			**$ 3,383,000**	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 2)

Date: August 1, 2014
Updated: December 5, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 5.3 mgd (Pipeline sized for 29.2 mgd)
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ 11,136,000	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ 175,000	
15 - Mechanical		$ -	
16 - Electrical		$ 35,000	
17- I&C		$ 18,000	
	RAW CONSTRUCTION COST	**$ 11,364,000**	
Construction Contingency	20%	$ 2,273,000	
	BASE CONSTRUCTION COST	**$ 13,637,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 4,091,000	
Easements		$ 170,000	
Project Contingency	10%	$ 1,790,000	
Land Acquisition Cost			
	TOTAL PROJECT COST	$ 19,688,000	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 11,136,000**	
	Brine pipeline	18	in	36,460	LF	$ 16.00	$ 10,500,000	Trenched pipeline to EBDA
	Railroad x'ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless crossing
	River x/ing	18	in	250	LF	$ 30.00	$ 135,000	Trenchless crossing
	Bore & Jack Pits	-	-	4	EA	$ 91,400.00	$ 366,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 175,000**	
	Pump station	10	hp	1	EA	$ 17,507	$ 175,000	Pumping to Coyote Point
15 - Mechanical							**$ -**	
							$ -	
16 - Electrical							**$ 35,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 35,000	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 2)

Date: August 1, 2014
Updated: December 5, 2014
Project Number: 0057-007.02
Prepared by: AG/JKT

AWPF Production Capacity 5.3 mgd (Pipeline sized for 29.2 mgd)
Estimate Type: Conceptual Planning

17 - I&C			**$**	**18,000**
I&C Allowance	10% of Division 11 (Equipment)	10%	$	18,000

EASEMENT ACQUISITION

	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
							$ 170,000
	Brine pipeline	18	in	36,960	LF	$ 4.60	$ 170,000

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 4,400**	
	Equipment Consumables	$ 175,000		2%	$ 4,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$ -	2% of Mechanical
	Instrumentation Consumables	$ 18,000		2%	$ 400	2% of Instrumentation
Power Costs				Total Power	**$ 9,000**	
	Pump station		Horsepower	10		
			Hours per year operation	8,059		
			Annual Cost		$ 9,000	Pumping to Coyote Point outfall
Chemicals				Total Chemicals	**$ -**	
					$ -	
					$ -	
					$ -	
Labor Costs				Total Labor	**$ 31,000**	
	Total # Operators	2	number			
	Average Annual Hours per operator	208	hrs/yr			Assume weekly inspection and cleaning.
	Total Operators per year	416	Total hrs	$ 75	**$ 31,000**	Two crew, 4 hrs/wk.
Other Costs				Total Other	**$ -**	
			TOTAL ANNUAL O&M COSTS		**$ 44,400**	

Project: SBWR Strategic and Master Plan

Date: August 1, 2014
Project Number: 0057-007.02

Component: Phase 3 - Alternative 1 (IPR)

Prepared by: AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ 38,417,000	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ 16,129,000	
15 - Mechanical		$ 184,000	
16 - Electrical		$ 3,226,000	
17- I&C		$ 520,000	
	RAW CONSTRUCTION COST	**$ 58,476,000**	
Construction Contingency	20%	$ 11,695,000	
	Centralized AWPF	$ 110,325,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 180,496,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 54,149,000	
Easements		$ -	
Project Contingency	10%	$ 23,465,000	
Land Acquisition Cost			
	TOTAL PROJECT COSTS	**$ 258,110,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 38,417,000**	
	Product pipeline	36	in	56,310	LF	$ 16.00	$ 32,435,000	Trenched pipeline to Los Gatos
	Hwy x'ings (x8)	36	in	2000	LF	$ 30.00	$ 2,160,000	Trenchless, adapted from District TM.8B
	Rail x'ings (x5)	36	in	500	LF	$ 30.00	$ 540,000	Trenchless, adapted from District TM.8B
	River x/ings (x2)	36	in	500	LF	$ 30.00	$ 540,000	Trenchless, adapted from District TM.8B
	Bore & Jack Pits	-	-	30	EA	$ 91,400.00	$ 2,742,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,129,000**	
	AOP System	20.0	mgd	1	LS	$ 9,505,359.26	$ 9,505,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 1,426,000	
	PWPS expansio	2000	hp	1	EA	$ 2,599	$ 5,198,000	Pump station to Los Gatos Ponds
15 - Mechanical							**$ 184,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 183,796	$ 184,000	Adapted from similar FAT project.

Project: SBWR Strategic and Master Plan

Component: Phase 3 - Alternative 1 (IPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

16 - Electrical			**$**	**3,226,000**	
Electrical Substation			$	-	
Electrical Allowance	20% of Division 11 (Equipment)	20%	$	3,226,000	AOP and PWPS only
17 - I&C			**$**	**520,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$	520,000	PWPS only

EASEMENT ACQUISITION

	Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**		**Total Cost**
							$	**-**
							$	-

ANNUAL O&M COSTS

		Amount	**Unit**	**Value**		**Cost**	
Consumables				Total Consumables	**$**	**2,175,000**	
	Equipment Consumables	$ 108,066,500		2%	$	2,161,000	2% of Equipment
	Mechanical Consumables	$ 184,000		2%	$	4,000	2% of Mechanical
	Instrumentation Consumables	$ 520,000		2%	$	10,000	2% of Instrumentation
Power Costs				Total Power	**$**	**7,219,000**	
	AWPF		Horsepower				
			Hours per year operation				
			Annual Cost		$	4,901,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	2,000			
			Hours per year operation	8,059			
			Annual Cost		$	1,801,000	Pumping to Los Gatos Ponds
	AOP		Horsepower				
			Hours per year operation				
			Annual Cost		$	517,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$**	**1,953,000**	
	AWPF Chemicals				$	1,953,000	Adapted from SVAWPC Engineer's Report + AOP from similar FAT project
Labor Costs				Total Labor	**$**	**1,560,000**	
	Total # Operators	10	number				Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr				average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	**$**	**1,560,000**	$75/hr
Other Costs				Total Other	**$**	**-**	
	Recharge Pond O&M				$	-	TBD
	RWF Secondary Effluent				$	-	Assume no cost
			TOTAL ANNUAL O&M COSTS		**$**	**12,907,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 3 - Alternative 2 (IPR+DPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 33,642,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 16,129,000	
15 - Mechanical	$ 184,000	
16 - Electrical	$ 3,226,000	
17- I&C	$ 520,000	

	RAW CONSTRUCTION COST	**$ 53,701,000**	
Construction Contingency	20%	$ 10,740,000	
	Centralized AWPF	$ 110,325,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 174,766,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 52,430,000	
Easements		$ -	
Project Contingency	10%	$ 22,720,000	
Land Acquisition Cost			
	TOTAL PROJECT COST	**$ 249,916,000**	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 33,642,000**	
	Product pipeline	36	in	14,070	LF	$ 16.00	$ 8,104,000	Trenched pipeline to Los Gatos
	Product pipeline	30	in	41,210	LF	$ 16.00	$ 19,781,000	Trenchless, adapted from District TM.8B
	Hwy x'ings (x3)	36	in	750	LF	$ 30.00	$ 810,000	Trenchless, adapted from District TM.8B
	Hwy x'ings (x5)	30	in	1250	LF	$ 30.00	$ 1,125,000	Trenchless, adapted from District TM.8B
	Rail x'ings (x5)	36	in	500	LF	$ 30.00	$ 540,000	
	River x/ings (x2)	36	in	500	LF	$ 30.00	$ 540,000	
	Bore & Jack Pits	-	-	30	EA	$ 91,400.00	$ 2,742,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,129,000**	
	AOP System	20.0	mgd	1	LS	$ 9,505,359.26	$ 9,505,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 1,426,000	
	PWPS expansion	2000	hp	1	EA	$ 2,599	$ 5,198,000	Pump station to Los Gatos Ponds
15 - Mechanical							**$ 184,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 183,796	$ 184,000	Adapted from similar FAT project.

Project: SBWR Strategic and Master Plan

Component: Phase 3 - Alternative 2 (IPR+DPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

16 - Electrical			**$**	**3,226,000**	
Electrical Substation			$	-	
Electrical Allowance	20% of Division 11 (Equipment)	20%	$	3,226,000	AOP and PWPS only
17 - I&C			**$**	**520,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$	520,000	PWPS only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	
						$	**-**
						$	-

ANNUAL O&M COSTS

		Amount	Unit	Value		Cost	
Consumables				Total Consumables	**$**	**2,175,000**	
	Equipment Consumables	$ 108,066,500		2%	$	2,161,000	2% of Equipment
	Mechanical Consumables	$ 184,000		2%	$	4,000	2% of Mechanical
	Instrumentation Consumables	$ 520,000		2%	$	10,000	2% of Instrumentation
Power Costs				Total Power	**$**	**7,670,000**	
	AWPF		Horsepower				
			Hours per year operation				
			Annual Cost		$	4,901,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	2,500			
			Hours per year operation	8,059			
			Annual Cost		$	2,252,000	Pumping to Los Gatos Ponds
	AOP		Horsepower				
			Hours per year operation				
			Annual Cost		$	517,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$**	**1,953,000**	
	AWPF Chemicals				$	1,953,000	Adapted from SVAWPC Engineer's Report + AOP from similar FAT project
Labor Costs				Total Labor	**$**	**1,560,000**	
	Total # Operators	10	number				Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr				average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	**$**	**1,560,000**	$75/hr
Other Costs				Total Other	**$**	**-**	
	Recharge Pond O&M				$	-	TBD
	RWF Secondary Effluent				$	-	Assume no cost
		TOTAL ANNUAL O&M COSTS			**$**	**13,358,000**	

Project: **SBWR Strategic and Master Plan**

Component: RO Concentrate Management - Coyote Point Outfall (Phase 3)

Date:	September 17, 2014
Project Number:	0057-007.02
Prepared by:	AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ -	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ 1,091,000	
15 - Mechanical		$ -	
16 - Electrical		$ 218,000	
17- I&C		$ 109,000	
	RAW CONSTRUCTION COST	**$ 1,418,000**	
Construction Contingency	20%	$ 284,000	
	BASE CONSTRUCTION COST	**$ 1,702,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 511,000	
Easements		$ -	
Project Contingency	10%	$ 221,000	
Land Acquisition Cost			
	TOTAL PROJECT COST	$ 2,434,000	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ -**	
							$ -	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 1,091,000**	
	PS expansion	220	hp	1	EA	$ 5,753	$ 1,091,000	Pumping to Coyote Point
15 - Mechanical							**$ -**	
							$ -	
16 - Electrical							**$ 218,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 218,000	
17 - I&C							**$ 109,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 109,000	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 3)

Date: September 17, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 24.5 mgd
Estimate Type: Conceptual Planning

EASEMENT ACQUISITION						Total Cost
Item	Size	Units	Quantity	Unit	Unit Cost	$ -

ANNUAL O&M COSTS		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 24,000**	
	Equipment Consumables	$ 1,091,000		2%	$ 22,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$ -	2% of Mechanical
	Instrumentation Consumables	$ 109,000		2%	$ 2,000	2% of Instrumentation
Power Costs				Total Power	**$ 198,000**	
	Pump station		Horsepower	220		
			Hours per year operation	8,059		
			Annual Cost		$ 198,000	Pumping to Coyote Point outfall
Chemicals				Total Chemicals	**$ -**	
					$ -	
					$ -	
					$ -	
Labor Costs				Total Labor	**$ 31,000**	
	Total # Operators	2	number			
	Average Annual Hours per operator	208	hrs/yr			Assume weekly inspection and cleaning.
	Total Operators per year	416	Total hrs	$ 75	**$ 31,000**	Two crew, 4 hrs/wk.
Other Costs				Total Other	**$ -**	
			TOTAL ANNUAL O&M COSTS		**$ 253,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 4 - Alternative 1 (IPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.3 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	**Subtotal**	**Notes**
2 - Sitework	$ 15,924,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 16,594,000	
15 - Mechanical	$ 36,000	
16 - Electrical	$ 2,843,000	
17- I&C	$ 1,422,000	

RAW CONSTRUCTION COST		**$ 36,819,000**	
Construction Contingency	20%	$ 7,364,000	
Centralized AWPFexpansion		$ 27,308,000	Adapted from SVAWPC ($46M for 8 mgd)
BASE CONSTRUCTION COST		**$ 71,491,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 21,447,000	
Easements		$ -	
Project Contingency	10%	$ 9,294,000	
Land Acquisition Cost		$ 17,090,000	21 acres of property acquisition needed
TOTAL PROJECT COST		**$ 119,322,000**	from District's TM.8C

Spec. Division	**Item**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
2 - Sitework							**$ 15,924,000**	
	Product pipeline	21	in	41,140	LF	$ 16.00	$ 13,823,000	Smaller line to Los Gatos well field
	Hwy x'ings (x1)	21	in	250	LF	$ 30.00	$ 158,000	Trenchless, adapted from District TM.8C
	Rail x'ings (x1)	21	in	100	LF	$ 30.00	$ 63,000	Trenchless, adapted from District TM.8C
	River x/ings (x3)	21	in	750	LF	$ 30.00	$ 473,000	Trenchless, adapted from District TM.8C
	Bore & Jack Pits	-	-	8	EA	$ 91,400.00	$ 731,000	
	Backflush piping	8	in	2,640	LF	$ 16.00	$ 338,000	Based on District's TM.8C
	Laterals to wells	8	in	2,640	LF	$ 16.00	$ 338,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 16,594,000**	
	PWPS expansio	2500	hp	1	EA	$ 2,399	$ 798,000	Upgrade to pump to Los Gatos ponds
	Injection wells	-	-	8	EA	$ 1,350,000	$ 11,131,000	Adapted from TM.8C costs w/o contingency
	Transfer PS	200	hp	1	EA	$ 11,442	$ 2,288,000	Transfer 4.7 mgd to injection wells
	AOP expansion	4.7	mgd	1	LS	$ 2,257,161.68	$ 2,257,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 120,000	

Project: SBWR Strategic and Master Plan

Component: Phase 4 - Alternative 1 (IPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.3 mgd
Estimate Type: Conceptual Planning

		Quantity	Unit	Unit Cost	Total Cost	
15 - Mechanical					**$ 36,000**	
	H2O2 tank + pumps + allowances	1	EA	$ 35,619	$ 36,000	Based on 9 mgd expansion
16 - Electrical					**$ 2,843,000**	
Electrical Substation					$ -	
Electrical Allowance	20% of Division 11 (Equipment)			20%	$ 2,843,000	AOP, pump stations and wells only
17 - I&C					**$ 1,422,000**	
I&C Allowance	10% of Division 11 (Equipment)			10%	$ 1,422,000	Pump stations and wells only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 3,450,000**	
	Equipment Consumables	$ 170,356,000		2%	$ 3,407,000	2% of Equipment
	Mechanical Consumables	$ 220,000		2%	$ 4,000	2% of Mechanical
	Instrumentation Consumables	$ 1,942,000		2%	$ 39,000	2% of Instrumentation
Power Costs				Total Power	**$ 8,900,000**	
	AWPF		Horsepower			
			Hours per year operation			
			Annual Cost		$ 5,851,000	Adapted from SVAWPC Engineer's Report
	PWPS		Horsepower	2,500		
			Hours per year operation	8,059		
			Annual Cost		$ 2,252,000	Pumping to Los Gatos Ponds
	Transfer PS		Horsepower	200		
			Hours per year operation	8,059		
			Annual Cost		$ 180,000	Transfer PS for 9.5 mgd to injection wells
	AOP		Horsepower			
			Hours per year operation			
			Annual Cost		$ 617,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 2,331,000**	
	AWPF Chemicals				$2,331,000	Adapted from SVAWPC Engineer's Report
					$ -	+ AOP from similar FAT project
					$ -	
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	$ 1,560,000	$75/hr
Other Costs				Total Other	**$ 618,000**	
	Recharge Pond O&M				$ -	TBD
	RWF Secondary Effluent				$ -	Assume no cost
	Injection well O&M	8.245208544	number	$ 75,000.00	$ 618,000	Adapted from similar injection project
				TOTAL ANNUAL O&M COSTS	**$ 16,859,000**	

Project: SBWR Strategic and Master Plan

Component: Phase 4 - Alternative 2 (IPR+DPR)

Date: August 1, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.3 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
2 - Sitework	$ 1,521,000	
3 - Concrete	$ -	
5 - Metals	$ -	
11 - Equipment	$ 8,229,000	
15 - Mechanical	$ 1,572,000	
16 - Electrical	$ 1,148,000	
17- I&C	$ 574,000	

	RAW CONSTRUCTION COST	**$ 13,044,000**	
Construction Contingency	20%	$ 2,609,000	
	Centralized AWPFexpansion	$ 27,308,000	Adapted from SVAWPC ($46M for 8 mgd)
	BASE CONSTRUCTION COST	**$ 42,961,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 12,888,000	
Easements		$ -	
Project Contingency	10%	$ 5,585,000	
Land Acquisition Cost		$ 814,000	Property acquisition for transfer PS
	TOTAL PROJECT COST	**$ 61,434,000**	based on District's TM.8C

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 1,521,000**	
	Pipeline extensio	36	in	2,640	LF	$ 16.00	$ 1,521,000	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 8,229,000**	
	PWPS expansio	3000	hp	1	EA	$ 2,246	$ 1,540,000	Upgrade to product water pump station
	Transfer PS	500	hp	1	EA	$ 8,402	$ 4,201,000	Transfer 9.5 mgd to Central Pipeline
	AOP expansion	4.7	mgd	1	LS	$ 2,257,161.68	$ 2,257,000	AOP from similar FAT project
	AOP Installation Allowances					15%	$ 231,000	
15 - Mechanical							**$ 1,572,000**	
	H2O2 tank + pumps + allowances			1	EA	$ 35,619	$ 36,000	Based on 9 mgd expansion
	Chlorine tank + pumps + allownaces			1	EA	$ 35,619	$ 36,000	Based on 9 mgd expansion
	Connection vault at Central Pipeline			1	LS	$ 1,500,000	$ 1,500,000	Sr. engineering estimate
16 - Electrical							**$ 1,148,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 1,148,000	Pump stations only

Project:	**SBWR Strategic and Master Plan**
Date:	August 1, 2014
Project Number:	0057-007.02
Prepared by:	AG/JKT

Component: Phase 4 - Alternative 2 (IPR+DPR)

AWPF Production Capacity	29.3 mgd
Estimate Type:	Conceptual Planning

17 - I&C			**$ 574,000**	
I&C Allowance	10% of Division 11 (Equipment)	10%	$ 574,000	Pump stations only

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 3,297,000**	
	Equipment Consumables	$ 161,991,000		2%	$ 3,240,000	2% of Equipment
	Mechanical Consumables	$ 1,756,000		2%	$ 35,000	2% of Mechanical
	Instrumentation Consumables	$ 1,094,000		2%	$ 22,000	2% of Instrumentation
Power Costs				Total Power	**$ 10,295,000**	
	AWPF	Horsepower				
		Hours per year operation				
		Annual Cost			$ 5,851,000	Adapted from SVAWPC Engineer's Report
	PWPS	Horsepower		3,750		
		Hours per year operation		8,059		
		Annual Cost			$ 3,377,000	Pumping to Los Gatos Ponds
	Transfer Pump Station	Horsepower		500		
		Hours per year operation		8,059		
		Annual Cost			$ 450,000	Transfer 9.5 mgd to Central Pipeline
	AOP	Horsepower				
		Hours per year operation				
		Annual Cost			$ 617,000	Adapted from similar FAT project.
Chemicals				Total Chemicals	**$ 2,512,000**	
	AWPF Chemicals				$ 2,331,000	Adapted from SVAWPC Engineer's Report
					$ -	+ AOP from similar FAT project
	Chlorine	181,056	gal	$ 1.00	$ 181,000	8 mg/L dose for free chlorine conveyance
Labor Costs				Total Labor	**$ 1,560,000**	
	Total # Operators	10	number			Assume 10 operators/engineers working
	Average Annual Hours per operator	2080	hrs/yr			average 40 hrs/wk with average labor of
	Total Operators per year	20800	Total hrs	$ 75	$ 1,560,000	$75/hr
Other Costs				Total Other	**$ -**	
	Recharge Pond O&M				$ -	TBD
	RWF Secondary Effluent				$ -	Assume no cost
		TOTAL ANNUAL O&M COSTS			**$ 17,664,000**	

Project: SBWR Strategic and Master Plan

Date: September 17, 2014
Project Number: 0057-007.02

Component: RO Concentrate Management - Coyote Point Outfall (Phase 4)

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
2 - Sitework		$ -	
3 - Concrete		$ -	
5 - Metals		$ -	
11 - Equipment		$ 690,000	
15 - Mechanical		$ -	
16 - Electrical		$ 138,000	
17- I&C		$ 69,000	
	RAW CONSTRUCTION COST	**$ 897,000**	
Construction Contingency	20%	$ 179,000	
	BASE CONSTRUCTION COST	**$ 1,076,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	$ 323,000	
Easements		$ -	
Project Contingency	10%	$ 139,900	
Land Acquisition Cost			
	TOTAL PROJECT COST	$ 1,538,900	

Spec. Division	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ -**	
							$ -	
3 - Concrete							**$ -**	
							$ -	
5 - Metals							**$ -**	
							$ -	
11 - Equipment							**$ 690,000**	
	PS expansion	375	hp	1	EA	$ 4,748	$ 690,000	Pumping to Coyote Point
							$ -	
15 - Mechanical							**$ -**	
							$ -	
16 - Electrical							**$ 138,000**	
Electrical Substation							$ -	
Electrical Allowance	20% of Division 11 (Equipment)					20%	$ 138,000	
17 - I&C							**$ 69,000**	
I&C Allowance	10% of Division 11 (Equipment)					10%	$ 69,000	

Project: SBWR Strategic and Master Plan

Component: RO Concentrate Management - Coyote Point Outfall (Phase 4)

Date: September 17, 2014
Project Number: 0057-007.02

Prepared by: AG/JKT

AWPF Production Capacity 29.2 mgd
Estimate Type: Conceptual Planning

EASEMENT ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost
						$ -
						$ -

ANNUAL O&M COSTS

		Amount	Unit	Value	Cost	
Consumables				Total Consumables	**$ 60,000**	
	Equipment Consumables	$ 2,734,000		2%	$ 55,000	2% of Equipment
	Mechanical Consumables	$ -		2%	$ -	2% of Mechanical
	Instrumentation Consumables	$ 273,000		2%	$ 5,000	2% of Instrumentation
Power Costs				Total Power	**$ 338,000**	
	Pump station		Horsepower	375		
			Hours per year operation	8,059		
			Annual Cost		$ 338,000	Pumping to Coyote Point outfall
Chemicals				Total Chemicals	**$ -**	
					$ -	
					$ -	
Labor Costs				Total Labor	**$ 31,000**	
	Total # Operators	2	number			
	Average Annual Hours per operator	208	hrs/yr			Assume weekly inspection and cleaning.
	Total Operators per year	416	Total hrs	$ 75	**$ 31,000**	Two crew, 4 hrs/wk.
Other Costs				Total Other	**$ -**	
			TOTAL ANNUAL O&M COSTS		**$ 429,000**	

Appendix 9A - Meeting Notes of Discussion with Palo Alto RWQCP

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South Bay Water Recycling
Strategic and Master Planning

Draft Meeting Notes

Subject: Palo Alto RWQCP Opportunities
Prepared by: Andria Loutsch, CDM Smith
Date/Time: Wednesday, June 5, 10-11 am
Location: PARWQCP
Attendees:
Ken Torke, City of Palo Alto
Jamie Allen, City of Palo Alto
Ken Davies, City of San Jose
Joanna De Sa, City of San Jose
Hossein Ashktorab, SCVWD
Jim Fiedler, SCVWD
Joan Maher, SCVWD
Tom Richardson, RMC
Andria Loutsch, CDM Smith
Reference: 2.4.1, 2.4.3

Purpose of Meeting

The objective of the meeting was to:

- Understand how the Palo Alto Water Quality Control Plant (RWQCP) and the District may be able to partner for regional concentrate management or recycled water planning

Discussion Summary

1. **Palo Alto's recycled water plans**

Palo Alto RWQCP supplied 849 acre-feet (AF) of recycled water last year to two retail customers, Palo Alto Water Utility and City of Mountain View. Of this amount, 550 AF was served to Mountain View. Mountain View will likely double their recycled water demand to roughly 1,500 AF when the salinity of the recycled water goes down. Currently Palo Alto provides recycled water to Mountain View free of charge. Mountain View wants to extend their contract.

The RWQCP's 1992 master plan documents potential recycled water demand in the region.

The City of Palo Alto does not have a near-term economic or water supply driver for expanding recycled water use. The City is below their SFPUC Individual Supply Guarantee. However, the City does want to keep recycled water in the supply mix because of concerns about the potential future cost of Hetch Hetchy water.

Plant capacity is 40 million gallons per day (mgd). Average flow at the treatment plant is 22 mgd. Wastewater flows have flattened – now at same flows or less than as in the 1970s. The ultraviolet (UV) system has a capacity of 4.5 mgd for recycled water production. If the turbidity levels were under 2 NTU, the UV system could operate at a higher capacity, but Palo Alto is not ready to do that yet because they would need more storage. Carollo's 2012 Long Range Facilities Plan includes ideas for plant expansion. The option of reverse osmosis was identified in the Long Term Facilities Plan if total dissolved solids (TDS) levels cannot be reduced through source reduction.

The RWQCP's short-term goal is to reduce salinity in the recycled water; however, the plant does not have control over the salt coming into their system. They probably won't look to expand recycled water system until salinity is reduced further. The City of Palo Alto has established a policy of not expanding their recycled water system until salinity of recycled water is reduced to below 600 mg/L TDS.

The RWQCP's recycled water used to have a TDS level of 1,200 mg/L. Salinity reduction projects were completed in the collection system which brought salinity down to 750 mg/L. Recycled water salinity could be reduced another 100 mg/L if a few known problem areas in Mountain View are fixed. Mountain View had stopped using recycled water at the golf course because the recycled water, which at that time had a TDS concentration of 900 mg/L, was killing grass. Now that the golf course has reinstituted the grass, they will begin taking recycled water again in July.

Since Palo Alto can't expand conventional recycled water uses due to high salinity, the concept of potable reuse was mentioned. It was noted that the Utilities Department operates eight wells, of which five to six have been rehabbed, and two new wells have been drilled for emergency use. The Utilities Department is pursuing a project to convert some of their emergency wells to normal use. Public Works staff has gotten conflicting information about whether that project is really moving forward. It was noted that with additional groundwater pumping capacity coming on-line, a potable reuse project at the RWQCP could be considered.

In the 1980s/1990s, Palo Alto and Stanford worked together on a recycled water master plan. Since, Stanford has moved away from recycled water as a supplemental water source. The Utilities Department has a project in the works to serve Stanford Research Park. Stanford would be a good customer because they already have a separate non-potable irrigation system. Stanford's existing irrigation water TDS level is about 550 mg/L, hindering Stanford's Real Estate Group's enthusiasm for recycled water. The university's water rights may also be a concern relative to use of recycled water.

2. Regional concentrate management/outfall opportunities

The RWQCP's outfall is 54-inches, built in 1960s, with capacity of 80 mgd. They normally treat 11-33 mgd with wet weather flows of 40-60 mgd (60-mgd events are rare), so there is excess capacity in their outfall. They suspect the outfall can't discharge 80 mgd during high tide.

The RWQCP discharges to salt marsh habitat, but to date has had no issues with toxicity.

3. **Other discussion items**

It was noted that if the City moves to using more groundwater (from the normal year well supply), this could change increase TDS levels.

East Palo Alto has recycled water in the water supply portfolio, about 0.1 mgd, but hasn't talked to the RWQCP about it. This potential demand is written up in the East Palo Alto Urban Water Management Plan.

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Appendix 9B - Meeting Notes of Discussion with Palo Alto Utilities

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RMC
Water andEnvironment

Meeting Notes

South Bay Water Recycling Strategic and Master Planning

Subject:	Regional Recycled Water Assessment – Meeting with Palo Alto Utilities
Prepared For:	Attendees
Prepared By:	Marc Nakamoto
Date/Time:	August 28, 2013 / 1:30 pm – 2:30 pm
Location:	Palo Alto Utilities Department
Project Number:	057-007.02

Attendees:
Phil Bobel, Jamie Allen, Ken Torke, Nicolas Procos (City of Palo Alto); Jim Fiedler, Hossein Ashktorab (SCVWD); Tom Richardson, Marc Nakamoto (RMC)

1. Purpose of Meeting

The objectives of the meeting were to:

- Provide Palo Alto Utilities with an overview of the SBWR Strategic and Master Planning process
- Obtain an update on Palo Alto's recycled water plans

2. Discussion Summary

2.1 SBWR Strategic and Master Plan Background

Tom walked the attendees through the background of the SBWR Strategic and Master Planning, noting that the planning initiative is a partnership between the City of San Jose (on behalf of the San Jose/Santa Clara Regional Wastewater Facility JPA) and the District. Although the focus of SBWR Strategic and Master Planning is to develop pathways to achieve recycled water planning targets and goals within the SBWR service area, the District also is interested assessing county-wide recycled water opportunities.

The purpose of the day's meeting was to gather information about Palo Alto's existing recycled water use, and plans for the future recycled water use. A secondary goal of the meeting was to initiate collaborative discussions on county-wide recycled water coordination and review potential visions for the future.

Tom noted that it is not practical to get to recycled water targets through non-potable reuse. IPR and/or direct reuse are the pathways to achieving large reuse targets. District is considering potable reuse options as a future pathway to use large quantities of recycled water to meet a RW goal of up to 50k AFY. Potable reuse pathways being considered as part of SBWR Strategic and Master Planning include groundwater replenishment via both surface spreading at the District's percolation ponds and injection of advanced treated "purified" recycled water into the groundwater basin. The latter option in particular would increase the artificial recharge of the groundwater basin, requiring increased groundwater production by retailers. GW regulations have evolved as the California Department of Public Health (CDPH) has become more comfortable with advanced treatment. Travel time in the groundwater basin is now on the order of 2 to 3 months. Long-term direct potable pathways include raw water augmentation upstream of surface water treatment plants and direct addition to the potable water system downstream of surface water treatment plants.

Regional concentrate management is also part of SBWR Strategic and Master Planning.

Jim Fiedler noted that the District is interested in partnering with others to expand recycled water use. District will be partnering with Sunnyvale to extend a recycled water pipeline to Apple's new campus.

District Board is motivated and is actively looking for other opportunities to partner on projects. District has a goal of reducing reliance on imported supply and having more local water supply.

3. City of Palo Alto Recycled Water Planning Update

Nicolas, Ken, Jamie, and Phil provided an update of the City's recycled water plans and insight on the existing water supply picture for the City. A summary of comments are presented below.

- Palo Alto has no near-term water supply issues as they have perpetual right to Hetch Hetchy water of 17.07 MGD. Palo Alto does not have a minimum purchase requirement like other South Bay customers. Palo Alto has a more advantageous Hetch Hetchy supply contract than other South Bay customers.
- City does not regularly pump any groundwater for supply. City has eight emergency wells. Wells depth is approximately 600 ft to a lower aquifer. Historically, City used all groundwater but went to full Hetch Hetchy supply in the 1960's to reduce seawater intrusion and subsidence.
- The City's Utility Advisor Commission (UAC) has evaluated the economics of increasing groundwater use (i.e. production cost model result in Jan/Feb 2014) relative to the increasing cost of Hetch Hetchy supply. Hetch Hetchy supply is projected to increase to above $2,000 per AF by 2020. UAC is engaged in the regional water picture.
- The City acknowledged that implementation of groundwater supply or recycled water could provide a basis for change to the Hetch Hetchy contract (i.e. change in the City allocation or requirement for a minimum purchase). There have been thoughts of potential sale of surplus Hetch Hetchy water to another BAWSCA agency. District has an interest in ensuring that Hetch Hetchy water stays within the Santa Clara County.
- Palo Alto is still working on getting approved CEQA document (EIR) for its recycled water system extension to Stanford Research Park (target demand roughly 850 AFY). Recycled water salinity (impact on redwood trees and other landscaping) is the biggest issue. Ken Torke illustrated the salinity reduction achieved thus far through collection system improvements and the pathway to achieve to further reduction. The City is pursuing USBR grant funding to build the project, which will move forward once salinity approaches the 600 mg/L target established by the City Council.
- Recycled water service to Stanford would improve project economics, and Stanford's utility department is interested in recycled water. However, Stanford's land management group has hesitated on committing to recycled water due to water quality concerns and potential implications on San Francisquito Creek surface water rights.
- Mountain View and the Palo Alto RWQCP have been discussing a long-term agreement for recycled water. The RWQCP will require Mountain View to address their salinity reduction opportunities as a prerequisite.
- It was noted that East Palo Alto water purveyors are studying more groundwater use, which would support a potable reuse project from the RWQCP. However, these areas are in San Mateo County and outside the jurisdiction of the District.
- Phil noted that he would generally be supportive of a potable reuse project and that "toilet to tap" moniker was likely not an issue as the community is highly educated and technology savvy.

4. Action Items

Action Item Summary Table

Task No.	Responsible Party		Due Date	Task/Action Item
	Organization	Name		
1	RMC	Marc Nakamoto	Sep 6, 2013	Distribute draft meeting notes.
2	District	Hossein Asktorab	TBD	Follow up with PARWQCP on discussions regarding partnership on recycled water development.

5. Attachments

The following materials were distributed at the workshop and are included as attachments to these meeting notes.

- Attachment 1 – City of Palo Alto TDS reduction figure

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Appendix 9C - Meeting Notes of Discussion with Mountain View

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Meeting Notes

South Bay Water Recycling Strategic and Master Planning

Subject: Meeting with Mountain View
Prepared For: Attendees
Prepared By: Marc Nakamoto
Date/Time: July 11, 2013 / 1:30 pm – 2:30 pm
Location: City of Mountain View
Project Number: 057-007.02

Attendees:
Gregg Hosfeldt, Alison Turner (City of Mountain View); Ken Davies (City of San Jose); Joan Maher, Hossein Ashktorab (SCVWD); Tom Richardson, Marc Nakamoto (RMC)

1. Purpose of Meeting

The objectives of the meeting were to:

- Provide City of Mountain View with an overview of the SBWR Strategic and Master Planning process
- Obtain an update on Mountain View most recent recycled water plans/projections

2. Discussion Summary

2.1 SBWR Strategic and Master Plan Background

Tom walked the attendees through the background of the SBWR Strategic and Master Planning , noting that the planning initiative is a partnership between the City of San Jose (on behalf of the San Jose/Santa Clara Regional Wastewater Facility JPA) and the District. Although the focus of SBWR Strategic and Master Planning is to develop pathways to achieve recycled water planning targets and goals within the SBWR service area, the District also is interested assessing county-wide recycled water opportunities. As a basis for this interest, Joan noted that the District has established County-wide recycled water use goals to support water supply sustainability. In line with the 2009 Delta Reform Act calling for reduced reliance on surface water, the District Board has established a goal of reducing the imported water component of its overall water supply to 50%. Tom provided a handout explaining the Regional Recycled Water Setting in North County (see Attachment 1).

The purpose of the day's meeting was to gather information about Mountain View's existing recycled water use, and plans for the future recycled water use. A secondary goal of the meeting was to initiate collaborative discussions on county-wide recycled water coordination and review potential visions for the future.

Tom noted that the District is considering potable reuse options as a future pathway to use large quantities of recycled water to meet RW goals. Orange County Water District's Groundwater Replenishment System is an example of successful implementation of large-scale (100 mgd) potable reuse. Potable reuse pathways being considered as part of SBWR Strategic and Master Planning include groundwater replenishment via both surface spreading at the District's percolation ponds, and injection of advanced treated "purified" recycled water into the groundwater basin. The latter option in particular would increase the artificial recharge of the groundwater basin, requiring increased groundwater production by retailers.

Regional concentrate management is also part of SBWR Strategic and Master Planning. One strategy would include constructing an RO concentrate line to either South Bayside System Authority (SBSA) or East Bay Dischargers Authority (EBDA)

3. City of Mountain View Recycled Water Planning Update

Greg and Alison provided an update of the City's recycled water plans. A summary of their comments are presented below.

- No near-term 10 to 15 year water supply issues due to the "guaranteed supply with a minimum purchase" provision of the City's Hetch Hetchy contract. City water demands have not increased much over recent years. Conservation may be offsetting development. Currently, City has a 4 to 5 mgd freeboard on Hetch Hetchy supply. Challenge in recent years has been using all of minimum purchase.
- City is doing feasibility study for RW expansion. About 75% complete. Existing average use around 400,000 gpd.
- Various recycled water expansion alternatives are being considered. Staff to develop recommendations to take to City Council. Pipeline to El Camino Hospital being considered.
- Alternatives to be presented to City Council to see what they want to do. Council generally approves projects with good/reasonable justification.
- Service to NASA being considered. Sunnyvale also considering service to NASA/Moffett area. Not sure who (Mountain View or Sunnyvale) will serve NASA. Connection between Sunnyvale and Mountain View may make sense in this area.
- Businesses in the Bayshore area considering their own on-site recycled water projects.
- Mountain View/Palo Alto agreement goes through 2035. Mountain View looking into extending agreement to provide reasonable term to support additional investments.
- Salinity is a concern and recent lining project has reduced salinity. Additional lining projects are planned to extend the life of sewers, with the added benefit of further salinity reduction
- Related to groundwater injection concepts, Alison noted that the city currently has artesian well conditions. It was noted that groundwater injection concepts are a long term concept and water supply conditions may not be the same as current.
- The Mountain View community is very sensitive to the quality of water. They get calls immediately when alternative water supplies are provided rather than Hetch Hetchy water.
- City indicated they can provide information on existing and future demands within the next couple of weeks.

4. Action Items

Action Item Summary Table

Task No.	Responsible Party		Due Date	Task/Action Item
	Organization	Name		
1	MV	Gregg/ Allison	7/26	Send estimates of existing and future RW use.
2				
3				

5. Attachments

The following materials were distributed at the workshop and are included as attachments to these meeting notes.

- Attachment 1 – Regional Recycled Water Setting – North County
- Attachment 2 – PARWQCP Recycled Water Market

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Appendix 10A - Long-Term Potable Reuse Program Implementation Schedule

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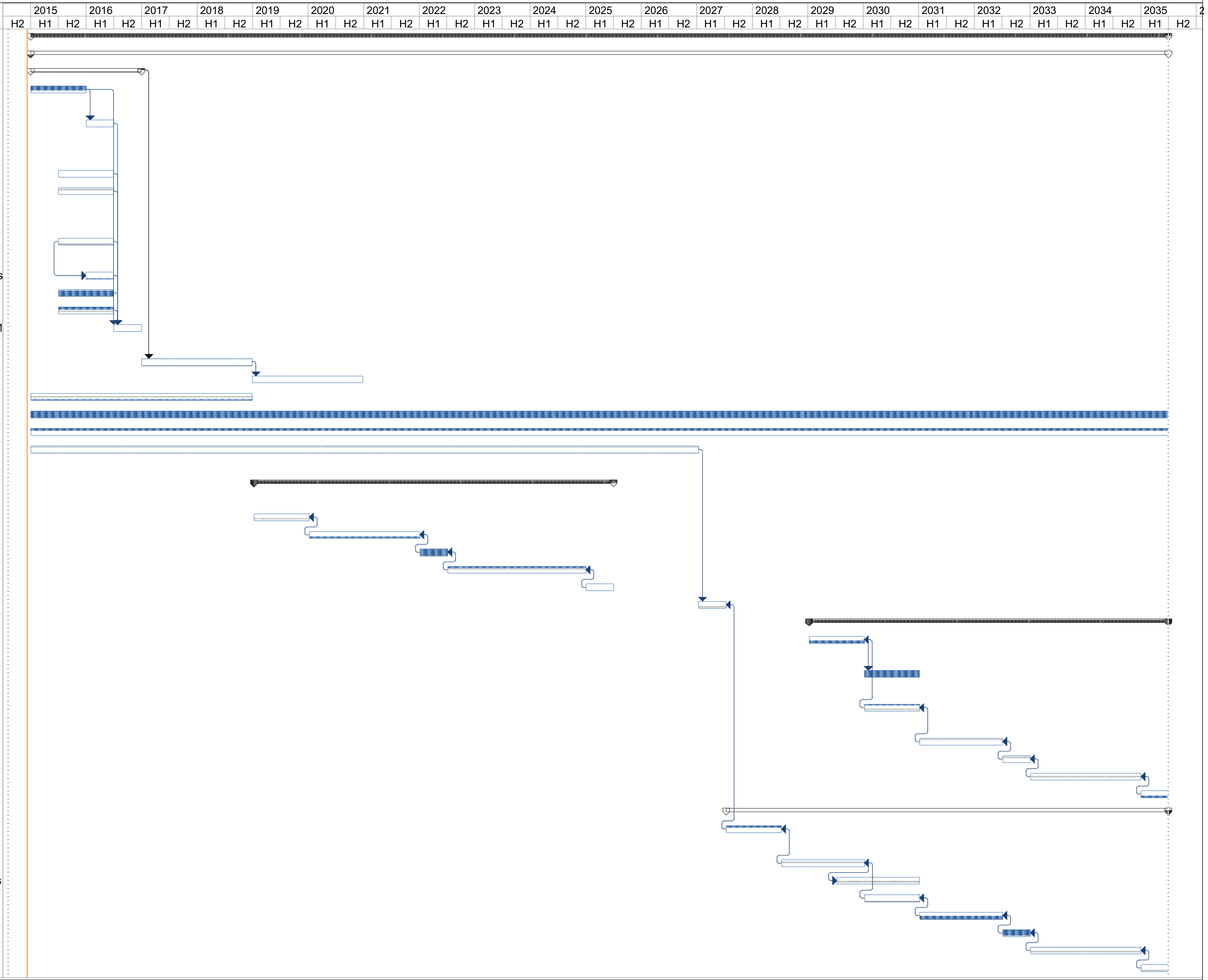
SBWR Strategic and Master Planning
Long-Term Potable Reuse Program Implementation Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Long-Term Potable Reuse Pathway**	**5347 days**	**1/1/15**	**6/29/35**	
2	**Programmatic Activities**	**5347 days**	**1/1/15**	**6/29/35**	
3	**Additional Studies for Long-Term Pathway**	**520 days**	**1/1/15**	**12/28/16**	
4	Reoperations Evaluation (In Conjunction with Near Term)	260 days	1/1/15	12/30/15	
5	Policy Discussion/Decision for Recycled Water Supply (In Conjunction with Near Term)	130 days	12/31/15	6/29/16	4
6	Conveyance Pipeline Alignment Analyses	260 days	7/1/15	6/28/16	
7	Groundwater Modeling/Analyses (Mid-basin injection wells, Los Gatos recharge ponds, Westside injection wells)	260 days	7/1/15	6/28/16	
8	Siting Analyses (Mid-Basin injection wells, Westside injection wells)	260 days	7/1/15	6/28/16	
9	AWPF Siting and Expansion Approach	130 days	12/30/15	6/28/16	8SS+130 days
10	Regulatory and Permitting Approach	260 days	7/1/15	6/28/16	
11	Additional Brine Management Studies	260 days	7/1/15	6/28/16	
12	Long-Term Potable Reuse Pathway Conceptual Design Report	130 days	6/30/16	12/28/16	4,5,6,7,8,9,10,1
13	Environmental Documentation	520 days	12/29/16	12/26/18	3
14	Permitting	520 days	12/27/18	12/23/20	13
15	Institutional Agreements	1040 days	1/1/15	12/26/18	
16	Public Outreach	5347 days	1/1/15	6/29/35	
17	Funding/Financing	5347 days	1/1/15	6/29/35	
18	Monitor Development of DPR Regulations and Advancement of DPR Projects	3138 days	1/1/15	1/11/27	
19	**Phase 2 - Mid-Basin Injection IPR & Phase 3 - Los Gatos Recharge Pond IPR**	**1690 days**	**1/9/19**	**7/1/25**	
20	Preliminary Design Report	260 days	1/9/19	1/8/20	21SF
21	Final Design	520 days	1/8/20	1/5/22	22SF
22	Bidding	130 days	1/5/22	7/6/22	23SF
23	Construction	650 days	7/6/22	1/1/25	24SF
24	Startup	130 days	1/1/25	7/1/25	
25	**Decision: Will Phase 4 be IPR or DPR?**	**130 days**	**1/12/27**	**7/12/27**	35SF,18
26	**Phase 4 - Westside Injection Wells IPR**	**1690 days**	**1/8/29**	**6/29/35**	
27	Update Initial Studies based on Phases 2 & 3 Operating Experience and Current Conditions	260 days	1/8/29	1/7/30	29SF
28	Modifications to CEQA/NEPA and Permitting (If needed)	260 days	1/7/30	1/3/31	27
29	Preliminary Design Report (AWPF, Pipelines, Injection Wells, Brine Management)	260 days	1/7/30	1/6/31	30SF
30	Final Design	390 days	1/6/31	7/5/32	31SF
31	Bidding	130 days	7/5/32	1/3/33	32SF
32	Construction	520 days	1/3/33	1/1/35	33SF
33	Startup	130 days	1/1/35	6/29/35	
34	**Phase 4 - Central Pipeline DPR**	**2080 days**	**7/12/27**	**6/29/35**	
35	Update Initial Studies based on Phases 2 & 3 Operating Experience and Current Conditions	260 days	7/12/27	7/10/28	36SF
36	CEQA/NEPA for DPR	390 days	7/10/28	1/7/30	38SF
37	Permitting for DPR	390 days	7/9/29	1/3/31	36FS-130 days
38	Preliminary Design Report	260 days	1/7/30	1/6/31	39SF
39	Final Design	390 days	1/6/31	7/5/32	40SF
40	Bidding	130 days	7/5/32	1/3/33	41SF
41	Construction	520 days	1/3/33	1/1/35	42SF
42	Startup	130 days	1/1/35	6/29/35	



Project: SBWR Long-Term PR
Date: 12/10/14

Task		Summary		External Milestone	◇	Inactive Summary		Manual Summary Rollup		Finish-only	]
Split		Project Summary		Inactive Task		Manual Task		Manual Summary		Deadline	⇩
Milestone	◇	External Tasks		Inactive Milestone	◇	Duration-only		Start-only	[	Progress	

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Appendix 11A - Recycled Water Rate Model

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Appendix 11A: Recycled Water Rate Model

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11A.1 Introduction

A recycled water “big picture” rate model was developed to identify a combination of pace of investment and pace of rate increase that supports system reliability and maintains recycled water’s attractiveness to retailers while achieving cost recovery within a reasonable period of time. As a “big picture” model, detailed breakdown of O&M costs and expenses, detailed current financial information, and other financial details are not incorporated into the model. The model focuses on future projections and allows for comparative analysis to get a big picture understanding of policy decisions, timing of the

- Focus of model was to evaluate cost recovery including annual SBWR O&M, asset repair and replacement, and future CIP.
- CIP based on maintaining level of service appropriate for customer base projected through 2020 (includes District 5 mgd potable reuse) (See Table 11A.1-1 for CIP).
- Model variables include CIP implementation timing, pace of demand growth, financing strategy, and outside funding.
- Projected District North County groundwater rate used as a point comparison and the basis of the upper threshold of recycled water rates (Figure 11A.2-1).
- Any project financing based on State Revolving Fund (2.7% interest, 30 years)
- 3% annual inflation rate for O&M and CIP scheduled in the future

The primary purpose of this wholesale rate model was to identify pathways to fund near-term CIP recommendations associated with this master plan through the wholesale rate structure. To support this analysis, it was assumed that existing debt associated with the SBWR program (SBWR system legacy CIP funded as part of the RWF and the SVAWPC funded by the District’s groundwater replenishment charge) would not be included in this rate model analysis. Inclusion of the existing debt service would result in a recycled water wholesale rate above groundwater rates (the current basis for setting of the recycled water wholesale rate). In addition, the existing SBWR debt service was taken on by the wastewater agencies/beneficiaries to address the RWF NPDES permit effluent flow cap. Since the need for effluent diversion has changed, policy makers could decide that recycled water wholesale rates need

Including the costs of the SVAWPC in the recycled water wholesale rate would result in a rate exceeding the District groundwater rate. The SVAWPC provides multiple benefits with a major benefit of salinity control to protect the groundwater quality. As protection of groundwater quality is a benefit to customers in the greater region, the SVAWPC capital costs have been funded by the groundwater rate. A policy change to cover the SVAWPC capital cost with the recycled water wholesale rate has minimal

The rate model evolved based on discussions with the City, District, and Stakeholders and was updated with functions to allow evaluation the implication of financial policy decisions such as inclusion of existing debt service and SVAWPC O&M costs

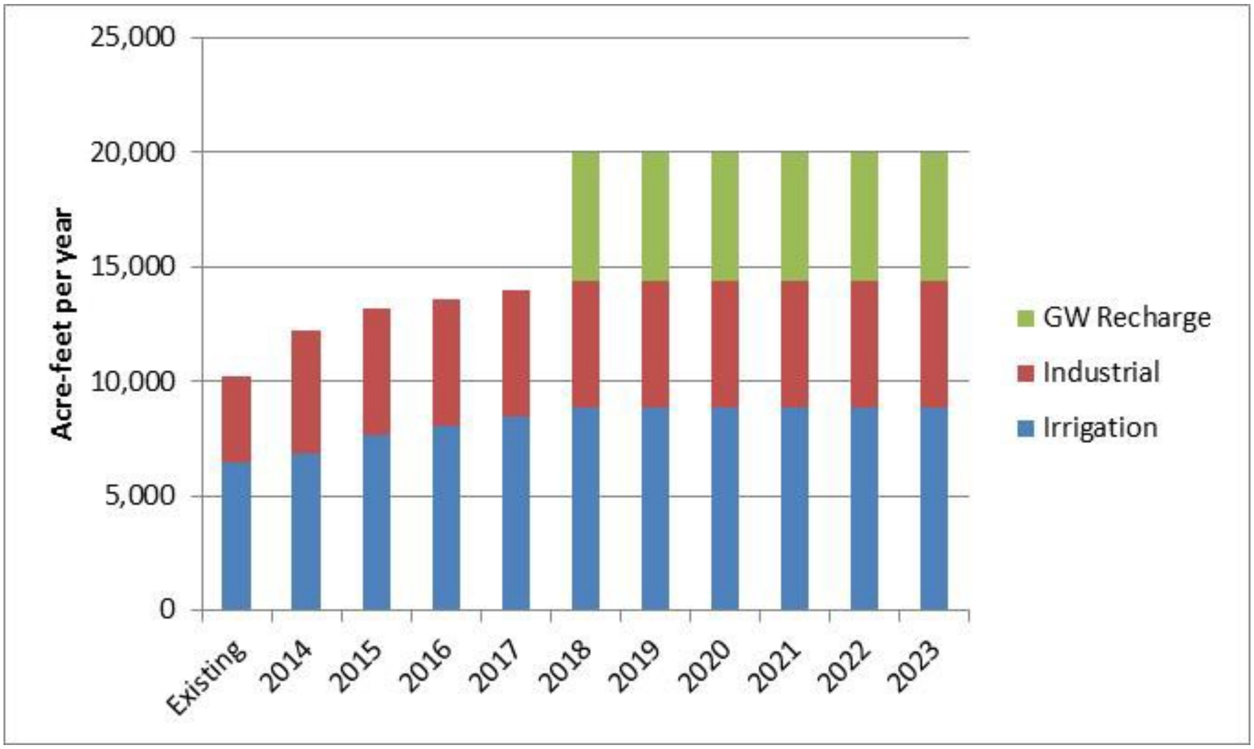
Table 11A.1-1: SBWR Capital Improvement Program

Project Number	Project Name	Estimated Cost Range
Increase Production Capacity		
P6	TPS Capacity Upgrade	$1 - $3 million
P8a	Filter Flux Rate	$75,000
P8b	Free Chlorine Disinfection Studies/Implementation	$500,000 - $1,000,000
Improve Distribution System (Peak Hour Capacity)		
D5	Upgrade Pump Station 5 Bypass	$300,000 - $500,000
D9	Zone 1 Storage	$40 million
Restore/Rehabilitate Existing Condition-Related Deficiencies		
D1a-1	PS 5 VFDs	$60,000
D1a-2	Other Condition Assessment Projects (2014-2015 Projects)	$2 million
D2	Valve Exercising Program	<$100,000/year
D11	PS 5 and PS8/11 Electrical Room HVAC replacement	$150,000 – $250,000
Update Control Strategies/Equipment to Improve Operational Efficiency		
P9a	Filter Backwash Automation[1]	$100,000 – $500,000
P9b	Distribution System Automation	$650,000 – $2,150,000
D6	Automate Zone Bypass Valve at Pump Station 8/11	<$50,000
Provide Operator Operations Support		
S5	Update SBWR Systems Operations Manual	$100,000 - $200,000
Total Cost of CIP		**$45 - $49 million**

Footnote:

1. The Filter Backwash Automation project is assumed to be a RWF project as majority of the project benefits the RWF For the rate model scenarios filter automation costs were excluded

Figure 11A.1-1: SBWR System Demand Projection



Note:

1. GW recharge represents the District 5 mgd IPR project from the Silver Creek Pipeline. This is an additional demand on the SBWR system

11A.2 Historic Recycled Water Rates and Background

Recycled water is typically priced at a discounted rate compared to other water supplies to incentivize its use. However, recycled water service has unique administrative and operational support which limits this discount. SBWR recycled water wholesale rate historically has been keyed to the District's north

This rising groundwater rate offers the potential for more revenue to be generated from sales of recycled water while still providing a discount for use of recycled water. Historically, industrial use has received a larger discount compared to irrigation use

Prior to 2009, the City received financial support ($115 per acre foot) from the District for the production and delivery of recycled water that would offset the potable water supply. When this incentive was discontinued, those costs were effectively shifted to sewer rate payers

In August 2012, recognizing that the wholesale recycled water rate structure was not covering the SBWR costs, the City Auditor recommended the City explore opportunities to achieve full cost recovery of SBWR operations by reducing costs, and increasing revenues, including having recycled water ratepayers

Figure 11A.2-1: Projected Water Supply Wholesale Rates

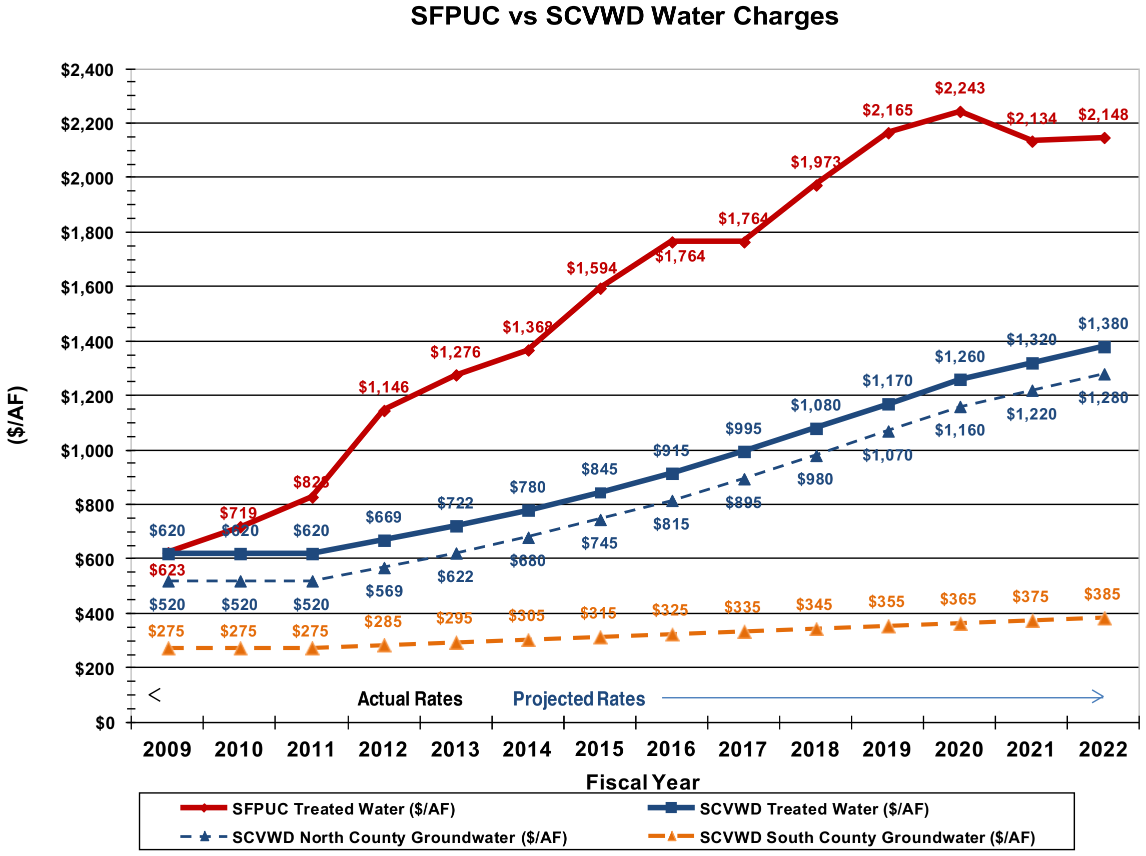


Table 11A.2-1: SBWR Wholesale Rate Discounts for Recycled Water by User type

Fiscal Year	Irrigation Users		Industrial Users		District Groundwater Rate
	Rate	Discount	Rate	Discount	
2004-2005	$240	$165	$40	$365	$405
2005-2006	$255	$165	$55	$365	$420
2206-2007	$270	$165	$70	$365	$435
2007-2008	$310	$165	$110	$365	$475
2008-2009	$375	$145	$175	$345	$520
2009-2010	$395	$125	$175	$345	$520
2010-2011	$415	$105	$195	$325	$520
2011-2012	$464	$105	$244	$325	$569
2012-2013	$517	$105	$297	$325	$622
2013-2014	$575	$105	$355	$325	$680
2014-2015	$642	$105	$532	$215	$747

11A.3 Rate Model Scenarios

Numerous model scenarios were run with a target of maintaining the cost of service at a level supporting recycled water wholesale rate at a minimum 15% discount from the groundwater rate. The following summarizes the scenarios that were modeled and the findings.

- Scenario 1 – SBWR O&M, R&R of $4.0 million starting FY2015, CIP rate[1] and debt funded
- Scenario 2 – SBWR O&M, R&R allocation build to $4.0M per year by FY2019, CIP rate and debt funded
- Scenario 3 – SBWR O&M, Reduced R&R allocation through FY2022, CIP rate funded only
- Scenario 4 – Scenario 2 plus revenue from District IPR project

11A.3.1.1 Scenario 1 – SBWR O&M, R&R of $4.0 million starting FY2015, CIP rate and debt funded

- In this scenario, the combination of SBWR O&M cost of $6.1 million and R&R reserve cost of $4.0 million push the required recycled water rate above the groundwater rate in initial years and a 15% discount could not be offered until FY 2018.

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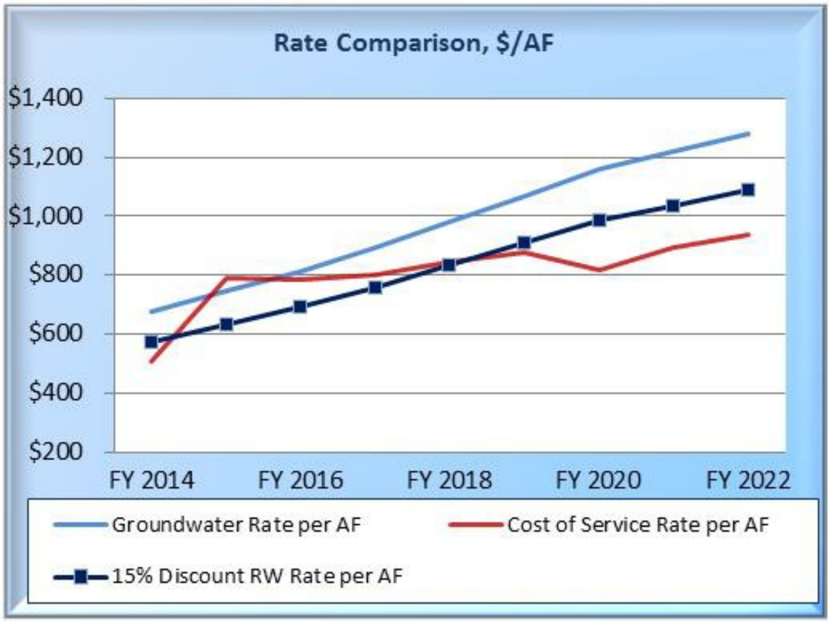
[1] CIP Rate Funded means projects are funded by available recycled water wholesale net revenues. Generally, small capital projects can be funded directly from revenue while large capital projects require debt financing. In lieu of debt financing, a capital project reserve fund could be established to save capital for a large project.

- *Commentary: Recovery of SBWR O&M and R&R reserve is a good step to cost recovery. However, since R&R reserve funds may not be needed right away, an incremental ramp up to $4.0 million is an approach to maintain a recycled water discount and address some capital needs.*

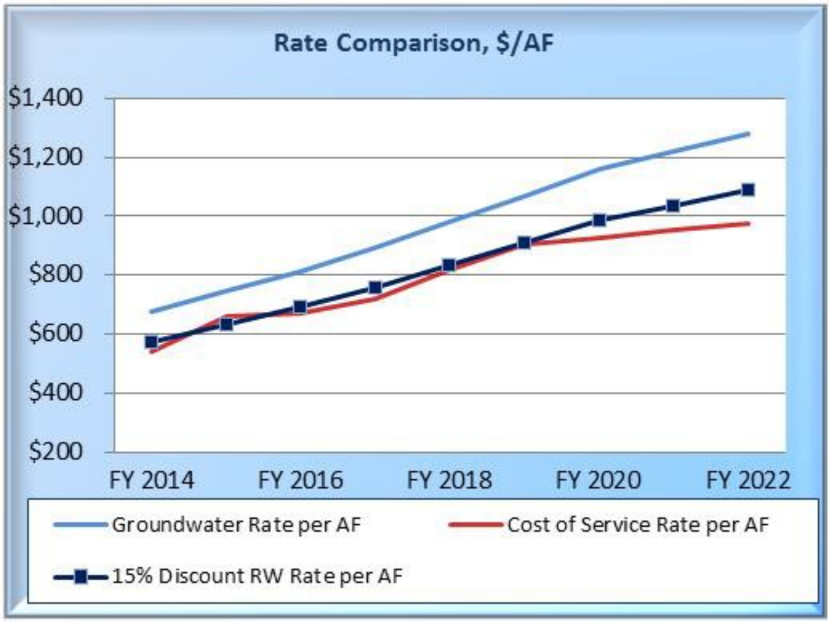
Figure 11A.3-1: Scenario 1 Required Recycled Water Rate



11A.3.1.2 Scenario 2 – SBWR O&M, R&R allocation build to $4.0M per year by FY2019, CIP rate and debt funded

- In this scenario, the R&R reserve is ramped up from $0.5M in FY2015 to $4.0M per year by FY2019 this facilitates moving forward with the CIP.
- The low capital cost CIP projects can be undertaken within the next 5-years and can be funded by rates. The storage project of $40 million could also be financed within 5-years and a recycled water whole rates could be maintained near the 15% discount target.
- *Commentary: In this scenario, the recycled water rate can ultimately be maintained below the 15% discount from the groundwater rate. This provides an opportunity to fund additional enhancement projects, build additional R&R reserve funds, or offer a larger discount in the*

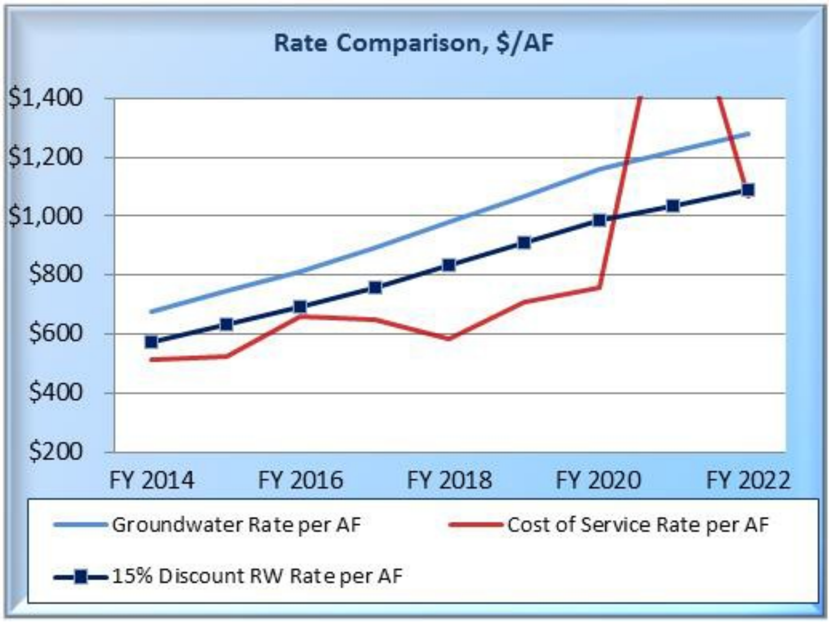
Figure 11A.3-2: Scenario 2 Required Recycled Water Rate



11A.3.1.3 Scenario 3 – SBWR O&M, Reduced R&R allocation through FY2022, CIP rate funded only

- In this scenario, the entire CIP would need to be funded by rates as no debt financing would be undertaken. In this scenario, the proposed CIP would need to be implemented over a longer period i.e. 10-years. A capital reserve fund is envisioned as all capital projects would be pay as you go.
- To accommodate the 10-year schedule for the CIP, the R&R reserves allocation was reduced to $0.5M per year through FY 2022. Beyond FY2022, the R&R allocation would be increased to $4.0M or greater as needed.
- *Commentary: The recycled water wholesale rate in this scenario would be set at a 15% discount from the groundwater rate. Recycled water revenue not used in a given year would be saved in the capital reserve fund and appropriated to the SBWR capital projects. A major advantage of this approach is that there would be significant recycled water revenue generating potential in*

Figure 11A.3-3: Scenario 3 Required Recycled Water Rate



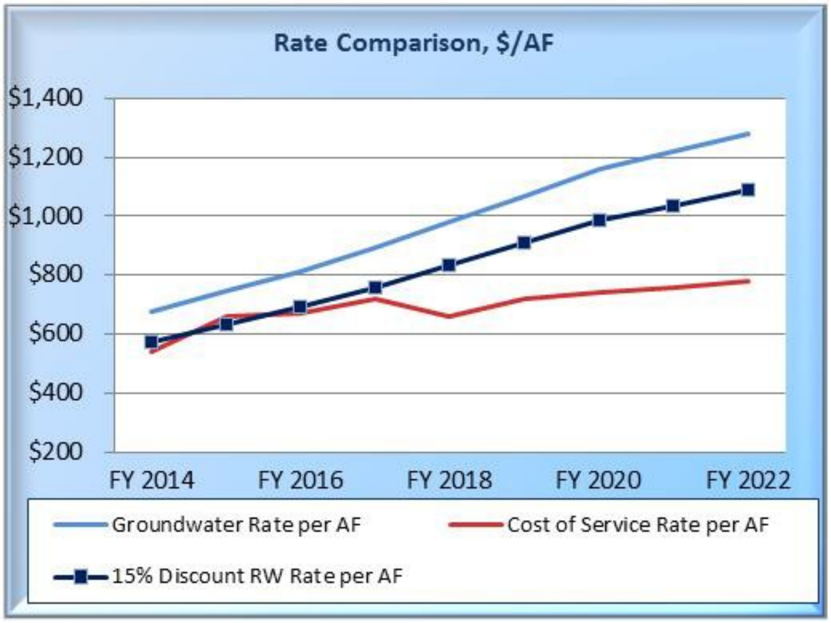
Notes:

1. In Scenario 3, the RW rate would be set at 15% discount of the groundwater rate. When the red line (Cost of Service) is below the 15% discount, excess revenue is generated that goes into a capital projects fund.
2. The Zone 1 Storage Project would be constructed in FY2021 therefore the cost of service line spikes in that year.
3. In this case, the cost of service line does not apply as the required recycled water rate as the capital fund would be leverage to pay for the Storage Project Capital.

11A.3.1.4 Scenario 4 – Scenario 2 plus revenue from District IPR project

- In this scenario, the 5 mgd District IPR project is assumed to be undertaken in FY2018. While the City and District have yet to agree on a recycled water cost, this scenario assumes all customers would be charged a uniform recycled water wholesale rate. The additional use of 5 mgd has the benefit of lowering the unit cost of service due to economies of scale.
- *Commentary: The 5 mgd increased use of recycled water could benefit the system with significant recycled water revenue generating potential providing the opportunity to fund other enhancement projects, system upgrades, or potential to offer a significant recycled water*

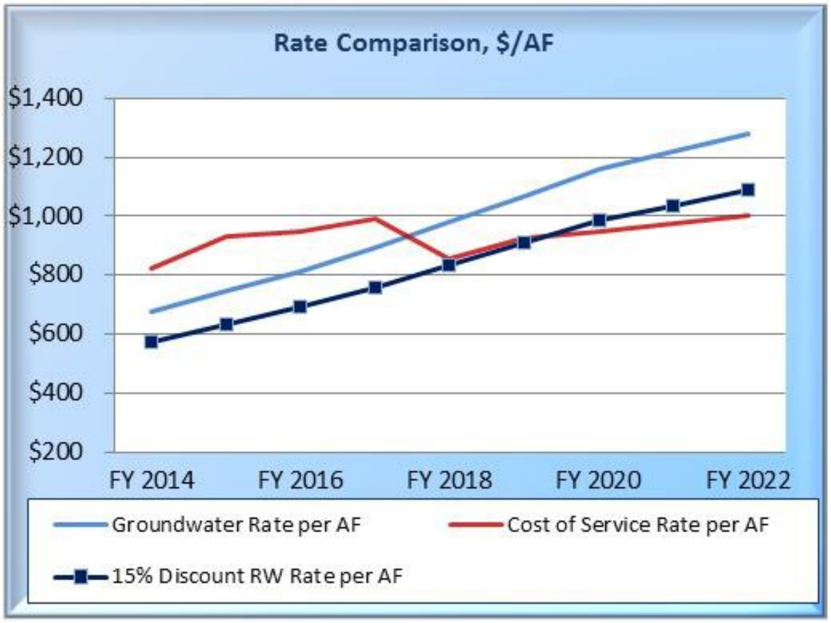
Figure 11A.3-4: Scenario 4 Required Recycled Water Rate



11A.3.1.5 Scenario 5 – Scenario 4 (including revenues from District IPR project) plus SVAWPC O&M Cost

- In this scenario, the SVAWPC O&M cost of $3.5 M is included and cost of service exceeds the groundwater rate.
- *Commentary: This scenario includes additional revenue from the 5 mgd District IPR project and indicates that starting in FY2018 (or onset of 5 mgd District use) the SVAWPC O&M cost could be absorbed into the recycled water rate while facilitating a discount from the groundwater rate.*

Figure 11A.3-5: Scenario 5 Required Recycled Water Rate



11A.4 Rate Model as a Tool

The wholesale recycled water rate model is a tool for comparatively evaluating scenarios in the future to support discussions on benefits, cost allocation, governance, and cost recovery. During the Strategic and Master Planning initiative, a recycled water wholesale rate stakeholder workshop was held, and a wide variety of perspectives on benefits, cost allocations, and existing agreement requirements were expressed. The master plan team was not able to model all of the various perspectives; rather the model has been provided to the stakeholders to facilitate further evaluation. Perspectives and opinions from

- Is the District's groundwater rate the correct basis of comparison? Is it the threshold for the recycled water rate?
- Are sustainability objectives and goals of current and potential future SBWR customers such a significant driver that recycled water retail rates could approach or exceed other water supply rates?
- What is the priority of costs to be covered by wholesale rate structure? Should existing debt service be a priority over SVAWPC O&M?
- Is a 15% discount from the groundwater rate adequate? Rather than a percentage, should the

The rate model provides a tool to support assessment of these and other scenarios as policy and governance discussions progress.

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